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April 1965

CENTRAL INTELLIGENCE AGENCY
PHOTOGRAPHIC INTELLIGENCE REPORT

DUAL HEN HOUSE RADAR SITES--ANGARSK, SARY-SHAGAN, AND OLENEGORSK, USSR



PHOTOGRAPHIC INTELLIGENCE DIVISION

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PREFACE

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This report is in response to requirement C-RR4-81,377, which requested: (1) annotated photos of the Angarsk facility from [redacted] Mission [redacted] (2) description and mensuration of linear installations and associated structures; (3) line drawings of linear installations and associated structures, indicating roads, trails, powerlines, security fencing, ground scarring; (4) indication of status of construction of each of the linear installations and nature and extent of progress since Mission [redacted] (5) detailed description of face of structure, including angle of slopes, length and width of possible faces; (6) determination of nature and status of third linear installation reported. It is also a response to requirement C-SI4-81,881, which requested line drawings and analysis of an installation located north-northwest of the HEN HOUSE-type installations at Sary-Shagan Site 13; to requirement C-SI4-81,900, which requested data regarding structural differences among the various Dual HEN HOUSE structures at Sary-Shagan Site 13, Angarsk, and Olenegorsk; and to requirement C-DI4-81,873, which requested a complete analysis of the possible connection between the building triad and the HEN HOUSE facilities at Sary-Shagan Site 13, including correlation with the Angarsk Dual HEN HOUSE facility.

Critical measurements, including all azimuths, heights, and angles of elevation presented in this report were accomplished by the NPIC Technical Intelligence Division (TID). The remainder of horizontal measurements were accomplished by the CIA/PID project analyst, using scale factors derived from the NPIC/TID measurements. Azimuths are considered by NPIC/TID to be accurate [redacted] NPIC/TID generally considers accuracy of meas-

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urements as follows: Horizontal distances computed from [redacted] photography on the order of plus or minus 5 feet or 5 percent, whichever is greater. With good quality [redacted] photography, plus or minus 10 feet or 5 percent, whichever is greater. The percentage of error decreases as distance increases and vice versa. Height accuracy is dependent on a number of variables other than photo quality. Under favorable conditions, with an uncomplicated object, accuracy is similar to that for horizontal distances; however, this is seldom the case with complex electronic devices or where height mensuration is dependent on determination of angular components and location of plumb points with unusual structures.

Measurements performed by the CIA/PID project analyst have an accuracy factor which is generally similar to that of the NPIC/TID measurements used for scale factors; however, they should be considered as approximate only.

Throughout this report dates of information are cited without specific references, in many instances, to the mission numbers from which the information was derived. The mission number and other pertinent photographic data may be obtained from the references at the end of the report.

(Cut-off dates for this report are as follows:)

Angarsk Dual HEN HOUSE Radar Site
Olenegorsk Dual HEN HOUSE Radar Site
Sary-Shagan Site 13
Sary-Shagan Radar Sites 1 and 2

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INTRODUCTION

The Angarsk Dual HEN HOUSE Radar Site (52-53N 103-15E), consisting of Dual HEN HOUSE-type antennas with adjacent support areas, was 1 of 3 known installations of this type under construction in the Soviet Union. The other 2 are located at Sary-Shagan Antimissile Test Center (SSATC), Site 13 (46-36N 74-32E) and at Olenegorsk (68-06N 33-54E), in the Murmansk area. Though this report is concerned primarily with Angarsk and Sary-Shagan Site 13, certain information on the prototype HEN HOUSE and HEN ROOST installations at Sary-Shagan Radar Sites No 1 and 2 will be included. A report on the Olenegorsk Dual HEN HOUSE Radar Site is contained in NPIC/R-855/64. 1/

The detailed descriptions of the Angarsk and Sary-Shagan facilities in this report are based primarily on an analysis of photography.

Information on construction progress since missions were accomplished is based in each case on 2 subsequent missions employing the system. In the case of Angarsk, additional coverage was secured while Sary-Shagan Site 13 was photographed.

To facilitate discussions of specific site components, the Dual HEN HOUSE facilities at each site are identified alphabetically in the sequence of their appearance. Individual HEN HOUSE antenna structures are numbered 1 and 2, with the former being the more northerly antenna. Where support facilities occupy more than a single area, the areas are numbered sequentially.

HISTORY OF THE HEN HOUSE INSTALLATIONS

RADAR SITE NO 1, SARY-SHAGAN ANTIMISSILE TEST CENTER

Prior to the discovery of the Angarsk activity in the only known HEN HOUSE antenna in the Soviet Union was located at Radar Site 1, SSATC

(45-59N 73-39E) (Figure 1). The activity at Angarsk could not at that early date be confirmed as electronics, though there were some strong suspicions regarding the unusually long excavations for probable structure foundations. The prototype HEN HOUSE at Radar Site 1 consisted of a single antenna structure, 915 feet long, high, and housing 41 light-toned panels, each measuring approximately 40 by 20 feet, in a face long, having a boresight angle of elevation. These dimensions and angles are portrayed in Figure 2 and represent a correction of dimensions and angles originally shown in PIC/JR-1010/61. 2/ Attached

to the left side of this antenna structure was a control building, 330 feet long, An addition to the control building, 100 by 75 feet and approximately 55 feet high, was constructed.

Subsequent photography has revealed 2 additional developments: photography revealed construction work on a new triangular-shaped installation adjacent to the HEN HOUSE control building. Additional missions in the following months revealed that

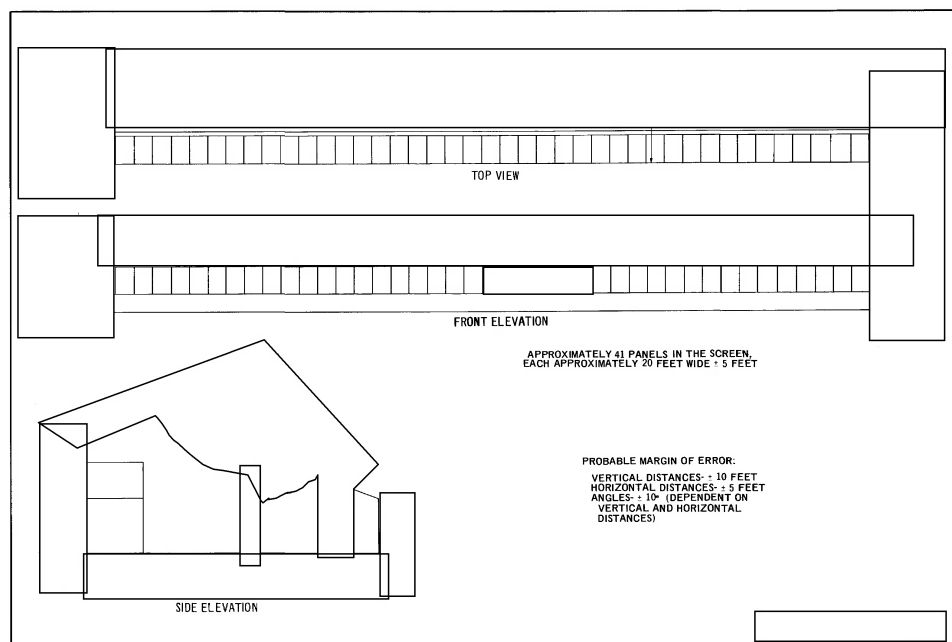


FIGURE 2. ELEVATIONS AT SSATC RADAR SITE 1.

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the new installation consisted of a 75- by 45-foot possible equipment building, 15 feet high, and a smaller suspect "feed house" at the apex of a flat, suspect ground plane (Figure 3).

In plan view, the suspect ground plane appears triangular with stepped or notched sides. Its surface is very light in tone and is raised possibly 5 to 10 feet above the ground. A rectangular 245-foot-wide and 110-foot-high suspect reflecting surface is erected at the eastern side of the suspect ground plane, approximately 225 feet from the possible equipment building. The suspect reflecting surface faces on the same azimuth as the adjacent HEN HOUSE antenna face. It is suspected that a perpendicular to the western facing surface has a small elevation angle above horizontal; however, the angle is too small to measure photogrammetrically. It is further suspected that this new addition is an over-the-horizon-type radar device, possibly being tested against missiles launched from Chelkar, Makat, or Kapustin Yar Missile Test Range to the Sary-Shagan impact area. 3/ No changes have been noted in this unique facility since

Probable modification of the HEN HOUSE antenna face, the second development, was first noted when a 190-foot section of the long antenna face appeared black. The black section consisted of 6 regularly spaced panels whose dimensions suggested the replacement of previously installed light-toned panels with larger black panels (Figure 3). permitted confirmation of the fact that the entire face was black sun azimuths of degrees and sun angles of 30 degrees and 30 degrees placed the antenna face in shadow. Consequently, appearance of the face could not be determined on Mission despite a favorable perspective ray azimuth of degrees for the forward camera. Missions also failed to reveal the face of the HENHOUSE because of unfavorable perspective ray azimuths and relatively poor ground resolution. revealed no change, the face remaining black. Though the photography revealed separations between individual black panels, the more recent photography does not permit detection of sectionalized paneling, despite relatively excellent photo quality.

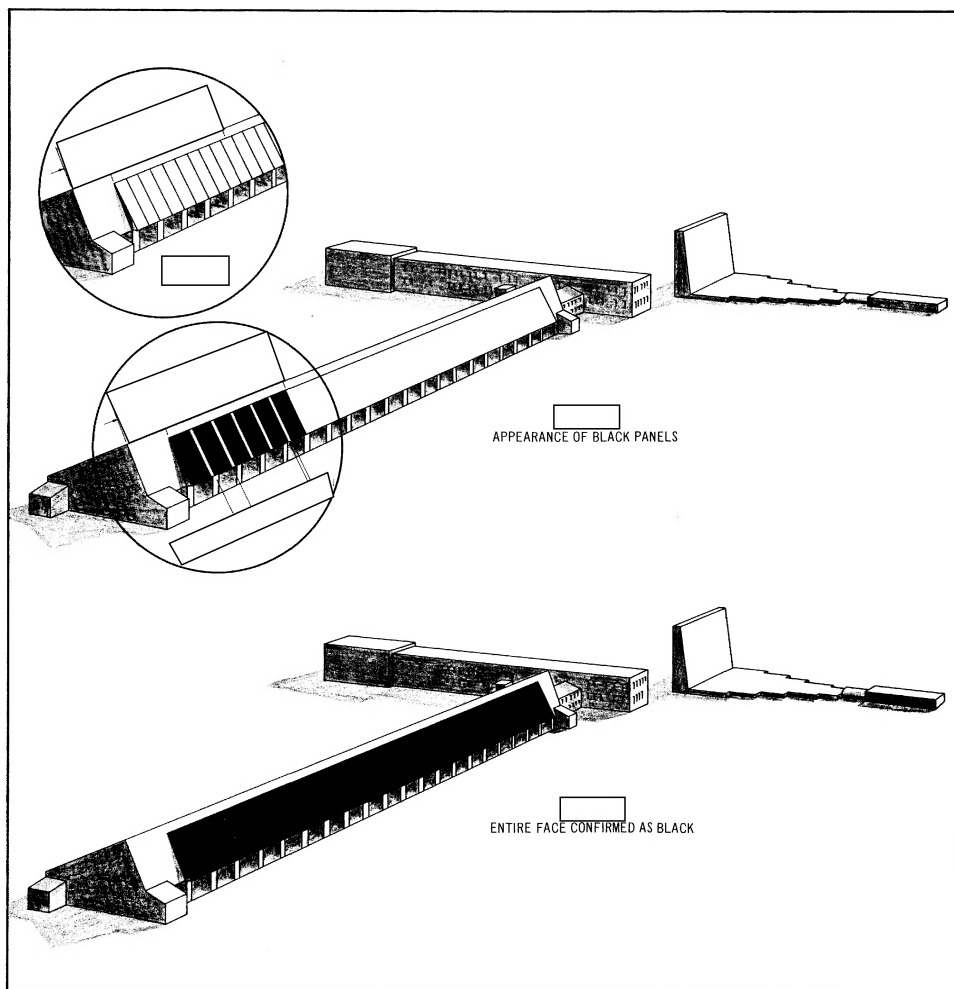


FIGURE 3. HEN HOUSE AT RADAR SITE 1, SSATC.

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SITE 13, SARY-SHAGAN ANTIMISSILE TEST CENTER

Sary-Shagan Site 13, located on the shores of Lake Balkhash, approximately 52 nautical miles (nm) northeast of the SSATC Support Base, did not exist when [] photographed the area. Activity at the site possibly had not started [] Poor photo quality precludes a more positive statement. First evidence of activity was secured by photography [] This mission revealed construction activity on a triad of buildings, which following missions confirmed as 1 of 4 unique installations having a counterpart around the city of Moscow, and believed to be possibly ABM-associated. 4/5/6/7/ For nearly 2 years, while construction activity continued, this possibly ABM-associated triad of buildings and a small support area constituted the only significant features at Sary-Shagan Site 13.

[] photography revealed that what had appeared to be a small borrow pit for the past 2 years was now being expanded by extensive excavation activity. As this new activity coincided with the construction of a new support area south of the building triad, and as the Angarsk Dual HEN HOUSE construction activity had not yet been discovered, the true purpose of this new excavation activity at Sary-Shagan Site 13 still was not identified. Photography [] revealed further expansion of this excavation, and at this time there was suspicion that the activity did in fact correlate with the prototype HEN HOUSE facility at Radar Site No 1, SSATC.

Photography [] revealed that the Sary-Shagan Site 13 construction activity had continued at a rapid pace. What is now recognized as Dual HEN HOUSE Radar Installation A was under construction approximately 1,000 yards northwest of the possible ABM-associated building triad, with a second, similar installation (Facility B) under construction in line with and just south of the first Dual HEN HOUSE. A portion of the control house superstructure was erected at Dual HEN HOUSE A, while footings for a probably similar building could be seen at the more southern facility. Probable superstructure could be seen at antenna A-1, while footings were probably in place for antenna A-2 and possibly for antenna B-1. The control build-

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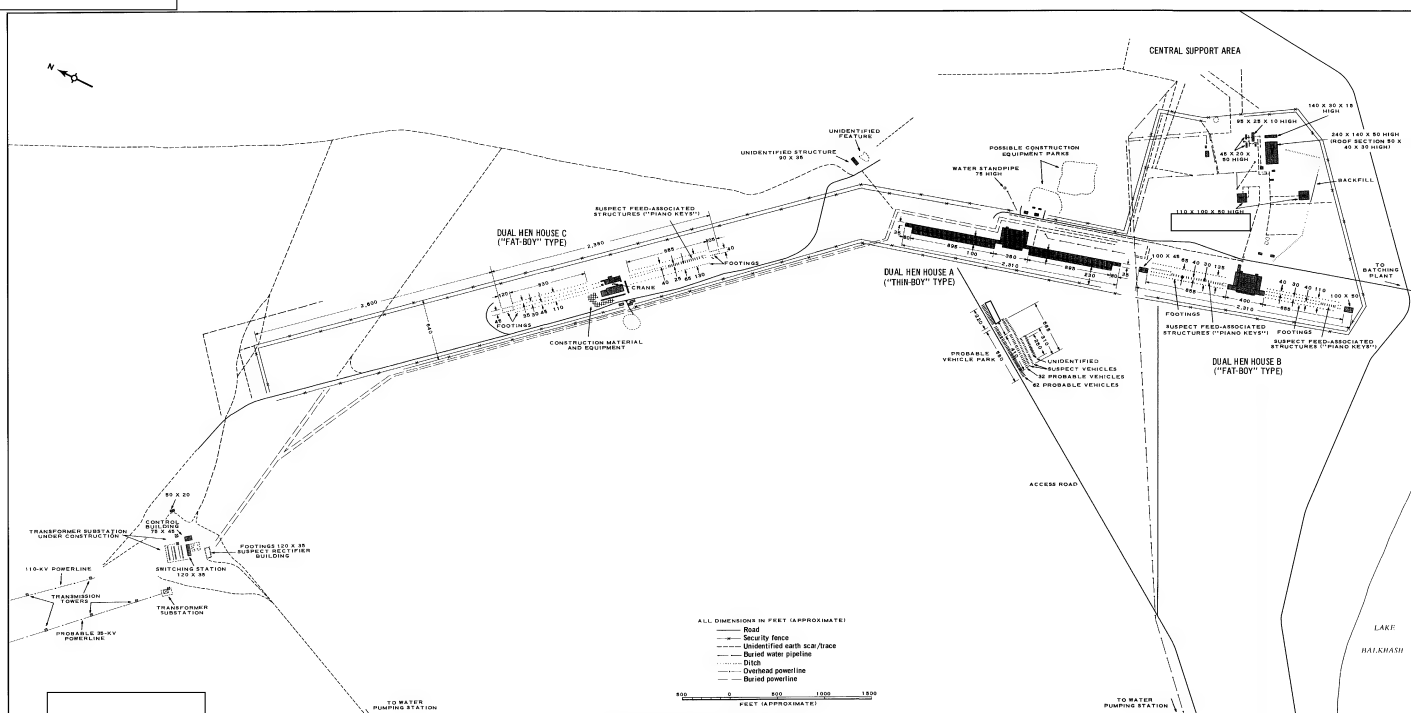


FIGURE 5. SSATC SITE 13 OPERATIONS AREA.

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Dual HEN HOUSE. Extensive cloud coverage of this portion of the site prevented further analysis.

A study of line drawings (Figures 5 and 6) reveals that plan dimensions and overall height of both HEN HOUSE structures at installation A are similar; however, they differ as to the location of the ridgeline, the pitch of roof and face and the height of vertical sections front and rear. At Dual HEN HOUSE B, the separation of linear footings and the placement of internal suspect feed-associated structures (to be referred to as "piano keys") differs from that seen at Facility A.

Footings for Dual HEN HOUSE C indicate that it probably will be similar to Dual HEN HOUSE B. Of particular significance is the relative size and placement of suspect transmitter and terminal buildings on each end of the various HEN HOUSE structures and their relationship to the

internal "piano keys." Note Figures 5 and 7.

Transmission towers for a probable 35-kv electric powerline and a 110-kv electric powerline can be seen approaching electric power transformer substations located approximately 2 nm northeast of Dual HEN HOUSE B (Figure 5). Presence of cables cannot be determined. Construction activity at the larger substation probably still continued as The powerlines will tie in to the main transmission lines running between the Balkhash area and the Sary-Shagan Main Support Base. The probable 35-kv line serves the town of Gulshat.

A probable buried water pipeline to the power substations from the water pumping station southeast of Gulshat was probably started sometime Buried electric powerlines from the substation area northwest of the site can be traced down as far

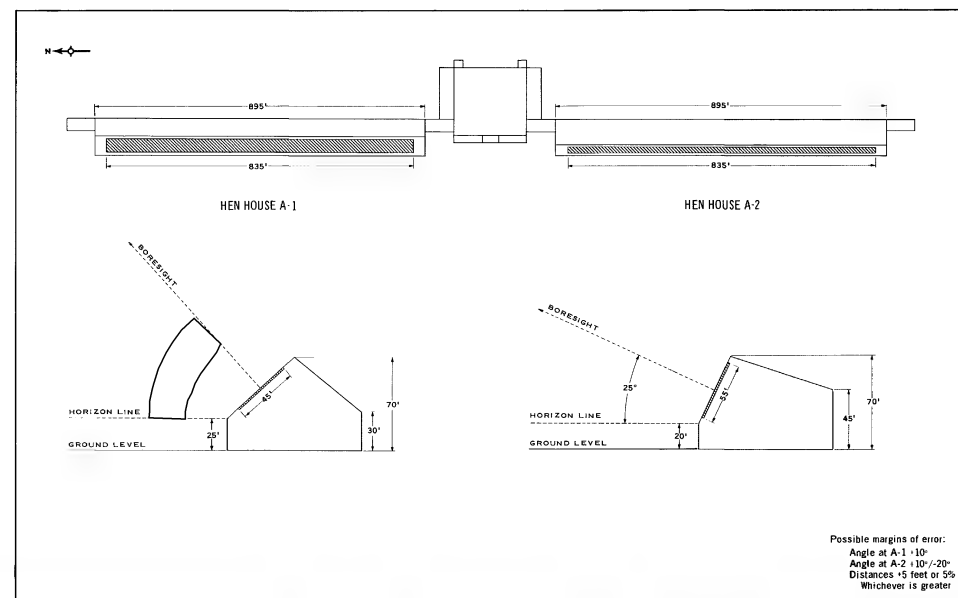


FIGURE 6. SIDE ELEVATION DIMENSIONS AND ANGLES OF BORESIGHT AT HEN HOUSE A, SSATC.

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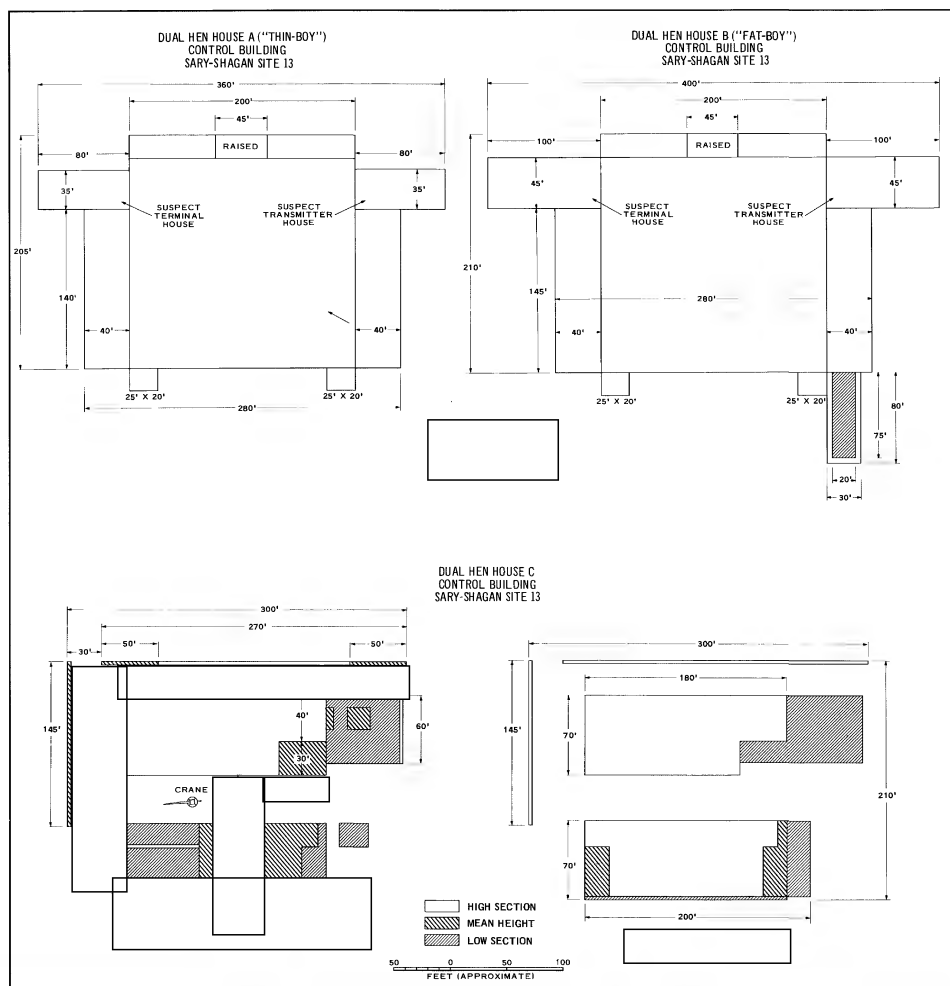


FIGURE 7. CONTROL BUILDINGS AT DUAL HEN HOUSES A, B, AND C, SSATC SITE 13.

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as the control building of Dual HEN HOUSE A; however, image motion on the otherwise excellent photography precludes positive tracing beyond this point. This buried powerline probably continues to Dual HEN HOUSE B. Prominent earth scars from the building triad approach the control building at Dual HEN HOUSE B and in one case a probable direct link exists between the northernmost small triad building and a unique open-walled structure attached to the rear of Dual HEN HOUSE B control building (Note Figures 5 and 7).

Figure 8 reveals prominent and possibly significant earth scars seen in the triad area plus a color code indicating the dates when the earth scars were first detected, including scars seen This graphic shows that new trenching activity in the area of the triad coincided with the construction activity on the Dual HEN HOUSE installations and continued

Available floorspace in support areas more than doubled (From 185,520 square feet to 416,160 square feet). It should be noted that the total available floorspace at Sary-Shagan Site 13 support areas is now approximately similar to that which will be available at the Angarsk Dual HEN HOUSE site. Note Figures 8 and 9.

Analysis of the larger-scale photography reveals that the dark objects just west of Dual HEN HOUSE A probably are vehicles. On this date the area contained 94 probable vehicles measuring approximately and an unknown number of smaller suspect vehicles. The number of suspect and probable vehicles increased when this group was first seen at this location Figure 10 depicts the chronology of this increase.

The rear walls of HEN HOUSE structures at installation A are in alignment with each other, with the rear of their suspect transmitter and terminal houses and with the rear of both sets of transmitter and terminal houses at Dual HEN HOUSE B. The rears of both "piano key" channels at installation B appear to be in alignment with each other and with the rear of their respective suspect transmitter and terminal houses. The front sides of HEN HOUSE structures at installation A are parallel to the front rows of footings for HEN HOUSE structures at

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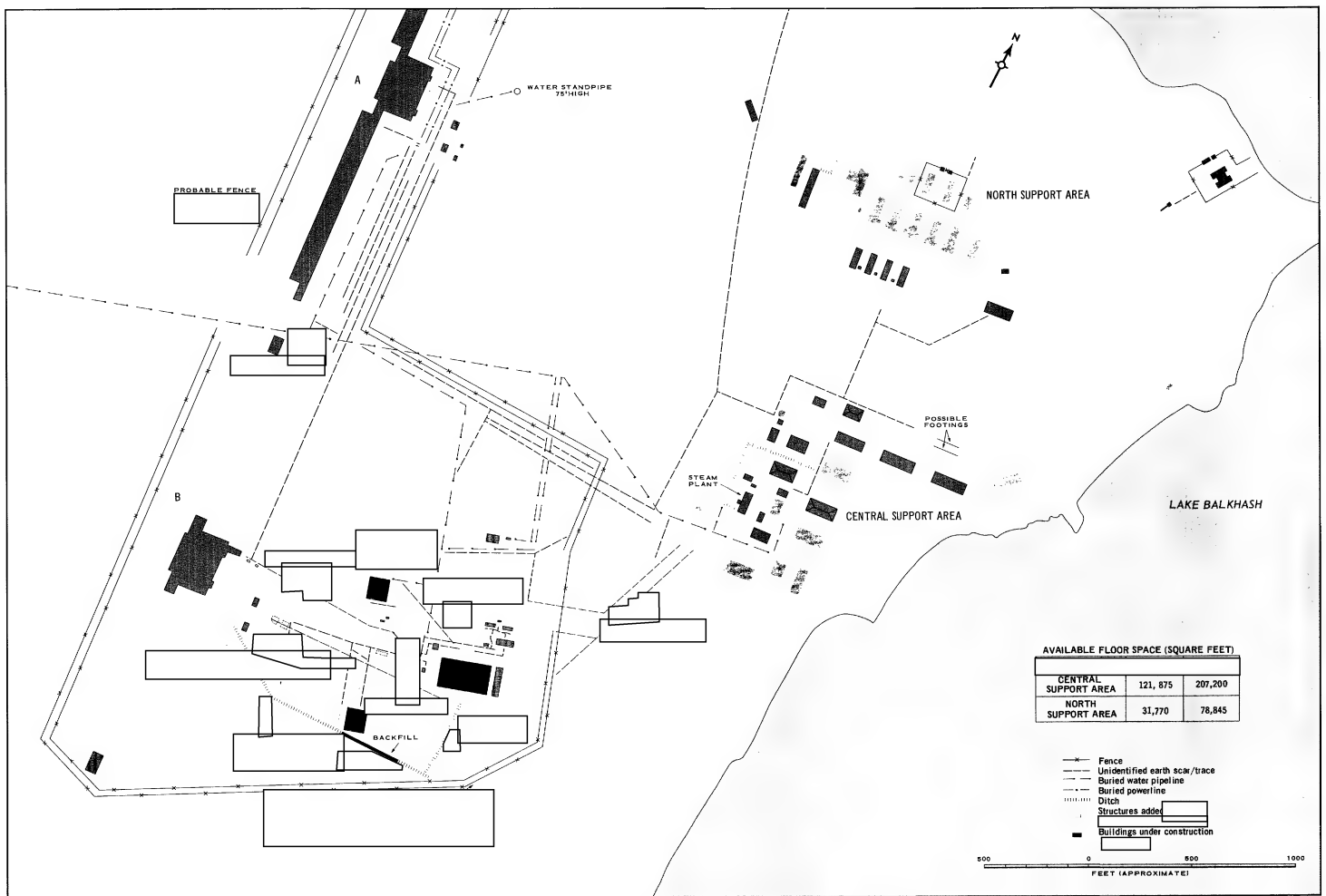


FIGURE 8. CHRONOLOGY AT TRIAD AREA AND NORTH AND CENTRAL SUPPORT AREAS, SITE 13, SSATC.

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installation B. However, the front footings at installation B are approximately 30 feet to the rear of the front sides of HEN HOUSES at installation A. Rear footings of the radar structures at Dual HEN HOUSE B are 65 feet behind the "piano key" channel at radar structure B-1 and 40 feet at radar structure B-2 (See Figure 5).

The square, dark tone surrounding the triad installation, visible on earliest and most subsequent photography of Site 13 suggests the possibility that a security fence (possibly temporary) at one time protected the construction activity at the triad.

OLENEGORSK ELECTRONICS SITE

Most recent of the Dual HEN HOUSE facilities to be discovered is located on the Kola Peninsula 68-08-00N

033-54-30E, approximately 11 nm east-northeast of Olenegorsk Airfield and 55 nm south-southeast of Murmansk (Figure 11). This facility was negated on [redacted] photography and first signs of construction activity were observed in the support area [redacted]

As seen in Figure 11, the Dual HEN HOUSE facility at Olenegorsk differs from the others in that the individual HEN HOUSE-type antennas are not in alignment. The probable boresight azimuths (perpendiculars to the long side of each structure) [redacted] and form an angle of 30 degrees.

These azimuths constitute a correction of azimuths previously reported and result from a refinement of ephemeral data [redacted] subsequent to the publication of NPIC/R-855/64. Accomplishment of better quality photography may result in further adjustment of azi-

muths, provided all critical ephemeral parameters are available.

ANGARSK DUAL HEN HOUSE RADAR SITE

[redacted] an unusual unidentified facility was discovered under construction near the banks of the Belaya River, approximately 35 nm northwest of Angarsk and 17 nm south-southeast of Cheremkhovo, at 52-53N 103-15E. Correlation of this activity with Instrumentation Site 13, SSATC, was immediately established.

Analysis of previous photography of the area revealed that [redacted] coverage probably negated the facility. However, partial cloud cover of what is now Support Area 2 precludes positive negation on that date. Poor quality of earlier photographic coverage also prevents positive negation. Probably the first indication of construction activity was photographed [redacted] The photo quality was poor; however, initial clearing and suspect early construction activity in Support Area 2 could be detected.

The first positive confirmation of construction activity resulted from good-quality [redacted] coverage [redacted] This photography revealed that construction of Dual HEN HOUSE Installation A had progressed to probable early stages of superstructure erection on the control building,

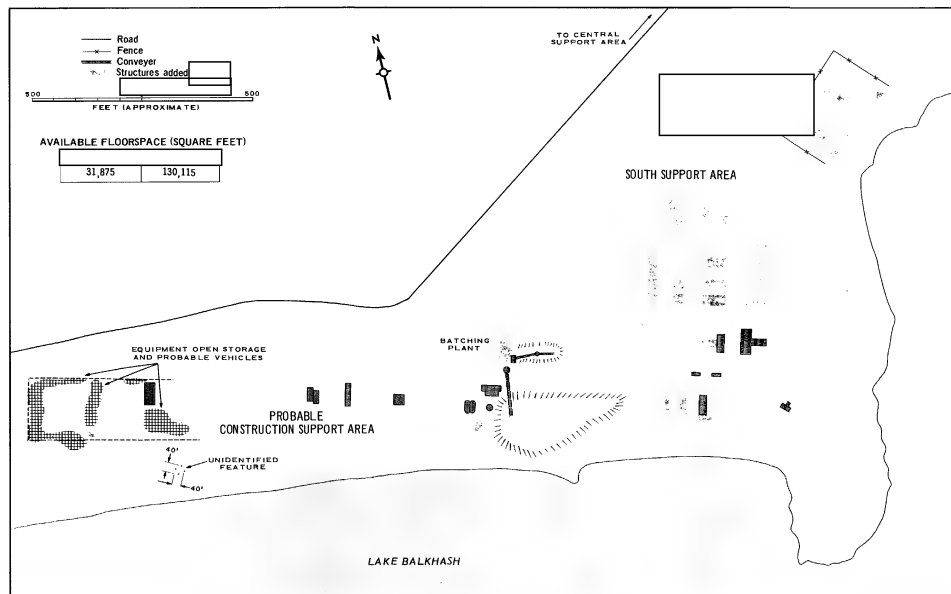


FIGURE 9. SOUTH SUPPORT AREA AT SITE 13, SSATC.

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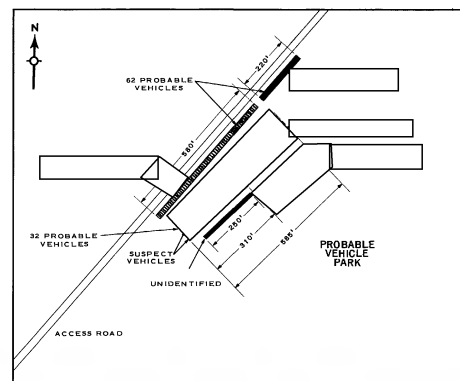


FIGURE 10. CHRONOLOGY OF VEHICLES NEAR DUAL HEN HOUSE A, SITE 13, SSATC.

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[redacted] and foundation excavations along the entire length of both antenna structures. At this time there was no evidence of construction or clearing activity for Dual HEN HOUSE Installations B, C, or D.

The progress of construction [redacted] is documented by previously published reports. 8/, 9/

Photographic coverage [redacted] was accomplished with the [redacted] system, resulting in relatively large-scale photography (Figure 12). Though light conditions during the satellite pass over Angarsk were less than optimum, the larger photo scale has permitted a far more detailed analysis than was previously possible. To provide for consistent annotations should additional facilities be constructed, the area designation system used in previous reports is changed to permit alphabetical designation of the Dual HEN HOUSE installations and numerical designation of support areas, as shown in Figure 13. The sequence of designation will, where possible, follow the chronological development of facilities.

General. The Angarsk Dual HEN HOUSE Radar Site occupies approximately 3,000 acres of flood plain in a bend of the Belaya River (Figure 12). It consists of a fenced operations area now containing 4 Dual HEN HOUSE radar installations under construction, with 3 closely grouped support areas about 1 nm to the northeast (Figure 13). Photography [redacted] revealed a 2,130- by 200-foot area had been cleared for the fourth Dual HEN HOUSE installation.

The only cultural features visible at this site prior to commencement of construction activity were a few probable dwellings along the river and a series of straight earth scars. These scars, consisting mostly of suspect survey lines, form a grid pattern in an area covered with medium to sparse vegetation. The grid pattern is formed by parallel lines oriented north/south, spaced approximately 1,000 meters apart, and intersected by east/west oriented parallel lines approximately 2,000 meters apart. Three straight, non-parallel, unidentified earth scars cross the area southwest of the site. These more prominent lines are generally oriented northeast/southwest.

It is not possible to negate these earth scars, nor is it possible to establish any relationship to the Dual HEN HOUSE facility, other than their geographic proximity and the orientation of the grid with reference to true north. The northwestern of the 3 more prominent scars runs

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through the area now occupied by the operations area, and more specifically by the control building of Dual HEN HOUSE A. The latter is possibly coincidental.

Communications. The facility is served by a possibly gravel-surfaced road which enters Support Areas 3 and 2 from the south, then turns to the southwest toward the operations area. There was no other prominent access to the facility [redacted]. From the site support area the road leads south to join a road which connects Mischelevka on the west to Malta and Tayturka on the east. The latter two communities are served by hard-surfaced roads and a double-tracked railroad which connects Irkutsk, Angarsk, and Cheremkhovo with points to the northwest and east. The airfield possibly serving this site would be Belaya Airfield, a medium bomber base [redacted] located approximately 10 nm to the east. Note Figure 12.

Defenses. The general area is defended by Cheremkhovo SAM Site B18-2, located approximately 6 nm southwest of the Dual HEN HOUSE facility, by Cheremkhovo SAM Site C10-2, located approximately 12 nm north-northeast of Belaya Airfield, and the northwestern SAM Sites in the Irkutsk/Angarsk SAM defense complex.

Utilities. Two parallel earth scars, which enter the area from the west, are possible evidence of power and telephone lines serving the support areas during the early construction period. Sometime [redacted] construction work began on an electric power substation in an area approximately 360 by 220 feet located between the operations area and Support Area 2. During the same period, work began on a water treatment plant located between the power substation and Support Area 2. Concurrent with this activity, a trench was dug for a pipeline from the Belaya River to the water treatment plant.

During the period [redacted] vegetation was cleared from a 110-foot-wide strip, forming a power trace leading southward toward the electric power substation from an area north of Support Area 2. The power substation was still in very early stages of construction, with no evidence of structures visible. Initial construction on a probable sewage treatment plant was also initiated during this period.

Photography [redacted] revealed construction progress on all utilities. In the electric power substation area, footings for possibly 2 stepdown, 3-phase, low-voltage transformers were under construction while wall-bearing construction on a [redacted] substation control house had reached the superstructure stage [redacted] the substation control house and an adjacent building measuring [redacted] feet were roofed. [redacted] a probable stack of canvas-covered building material measuring [redacted] feet was located approximately 200 feet northeast of the substation control house. This probable stack of material was not in evidence [redacted] Foundations for electric power transmission towers for 2 probable 110-kv powerlines with heavy, 3-phase conductors can be seen along the power trace extending north from the substation. Photography [redacted] revealed continuing work on the powerline, with power transmission tower footings newly identified northeast of the Belaya River. The power trace is thus being extended toward the electrified railroad near the town of Mikhaylovka (Figure 12).

A probable sewage treatment plant is being constructed north of Support Area 3 and downstream from the water intake point. It consists of 2 earth-embanked, [redacted] diameter, probable digesters and a sewage treatment and pumping station under construction. Between [redacted] the sewer pipeline from the sewage treatment plant was extended to Support Area 2 and to the Belaya River. Note Figure 14.

The water treatment plant, consisting of a [redacted] foot single-story, flat-roofed building and two 45-foot diameter semiburied presedimentation basins, will be fed by a buried water pipeline from the Belaya River. Photography [redacted] (Figure 14) reveals the circular basins have probably been covered. The intake end of the water pipeline ends at a slip-off slope north of Support Area 2. It is suspected that infiltration galleries are being constructed at that point.

From the water treatment plant, water pipeline trenches lead along the access road toward the operations area and toward Support Area 2. A number of trenches for water and sewer pipelines can be seen in Support Area 2. Probable pipe sections can be seen strung along the side of the access road between Support Area 2 and Support Area 3, probably preliminary to trench digging.

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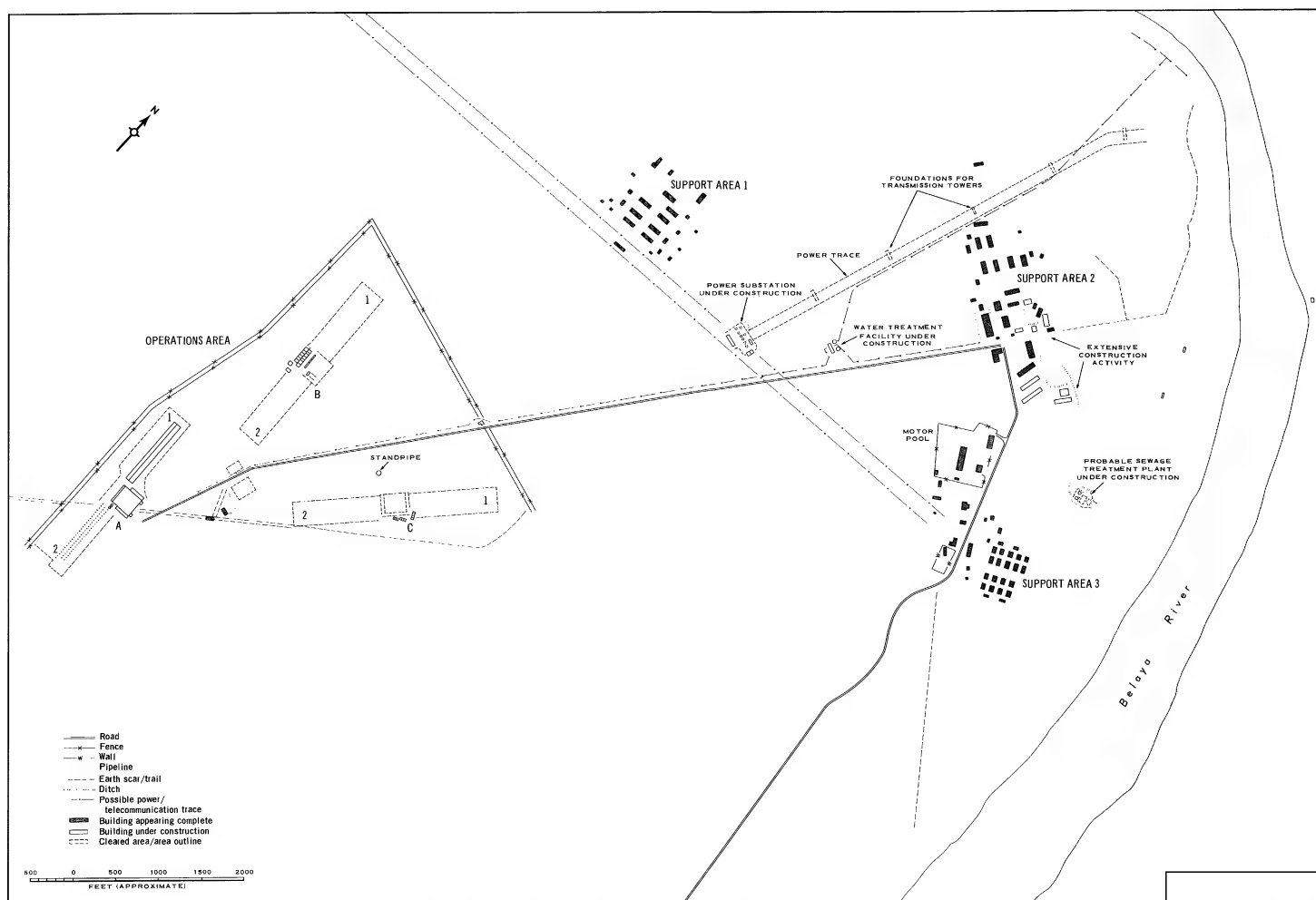


FIGURE 13. LINE DRAWING OF ANGARSK DUAL HEN HOUSE RADAR SITE

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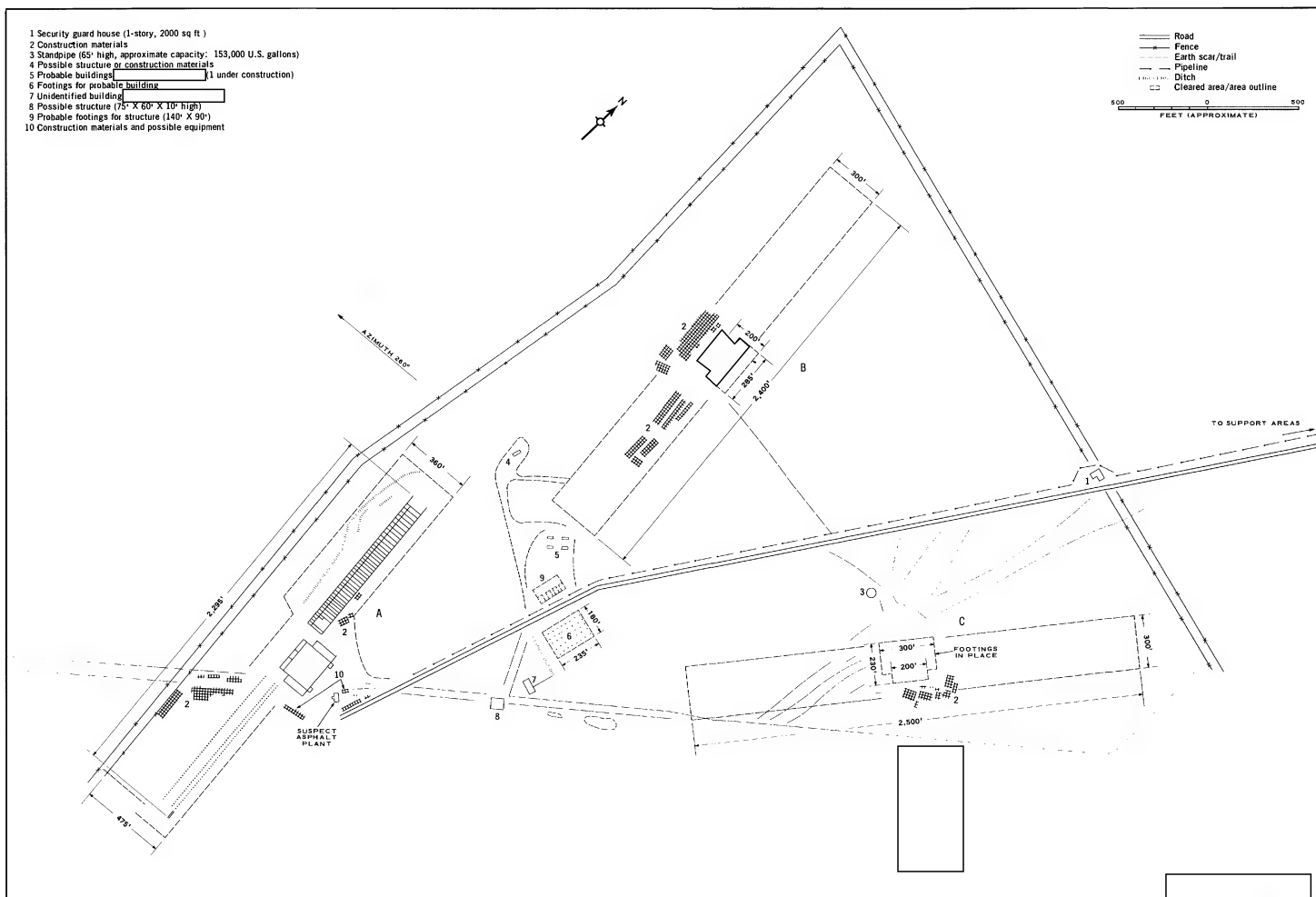
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25X1D Photography [] (Figure 17) revealed continued progress in the operations area (note line drawing, Figure 18), with excavation activity visible in the space for installation D.

25X1D Dual HEN HOUSE A. This installation consists of 2 HEN HOUSE-type radar structures under construction, 1 on each side of a massive control building. The 2 HEN HOUSE antenna structures are being constructed along the same longitudinal axis, with the mass of the control building located east of the line [] Dual HEN HOUSE A measured 2,295 feet from end to end. Photography [] revealed the probable addition of a small structure to the north end of HEN HOUSE A-1. If the dimensions of this addition are similar (*) to those of the structure off the south end of HEN HOUSE A-2, the total length of the Dual HEN HOUSE will be approximately 2,340 feet.

25X1D Photography [] confirmed that suspect transmitter and terminal houses are attached to each HEN HOUSE structure at Dual HEN HOUSE A. The rear sides of these small houses probably are aligned with the rear of the attached HEN HOUSE antenna structures.

25X1D The flat-roofed control building probably is constructed of reinforced concrete (Figures 15, 19, and 20). It consists of a 25-foot-high central section measuring [] wings on the north, south, and west, and 2 probable 10-foot-high wings on the east. The north and south wings measure 140 by 40 feet, the west wing [] and each of the 2 probable wings on the east measure 25 by 20 feet. The entire control building is located east of a line connecting the western sides of the 2 HEN HOUSE antenna structures.

25X1D The control building, which has approximately 44,000 square feet of roof area, did not appear complete [] Finishing work on the roof appeared to be in progress, with a suspect asphalt plant in operation on the east side of the building. Building material, pipe sections and 5 probable vehicles could be seen in the area [] Photography [] does not permit confirmation of construction status, though the building appears complete.

25X1D Photography [] revealed no changes in the control building; however the trench from the control

25X1D *Though the structures are approximately similar in size, the ground resolution [] does not permit a meaningful measurement.

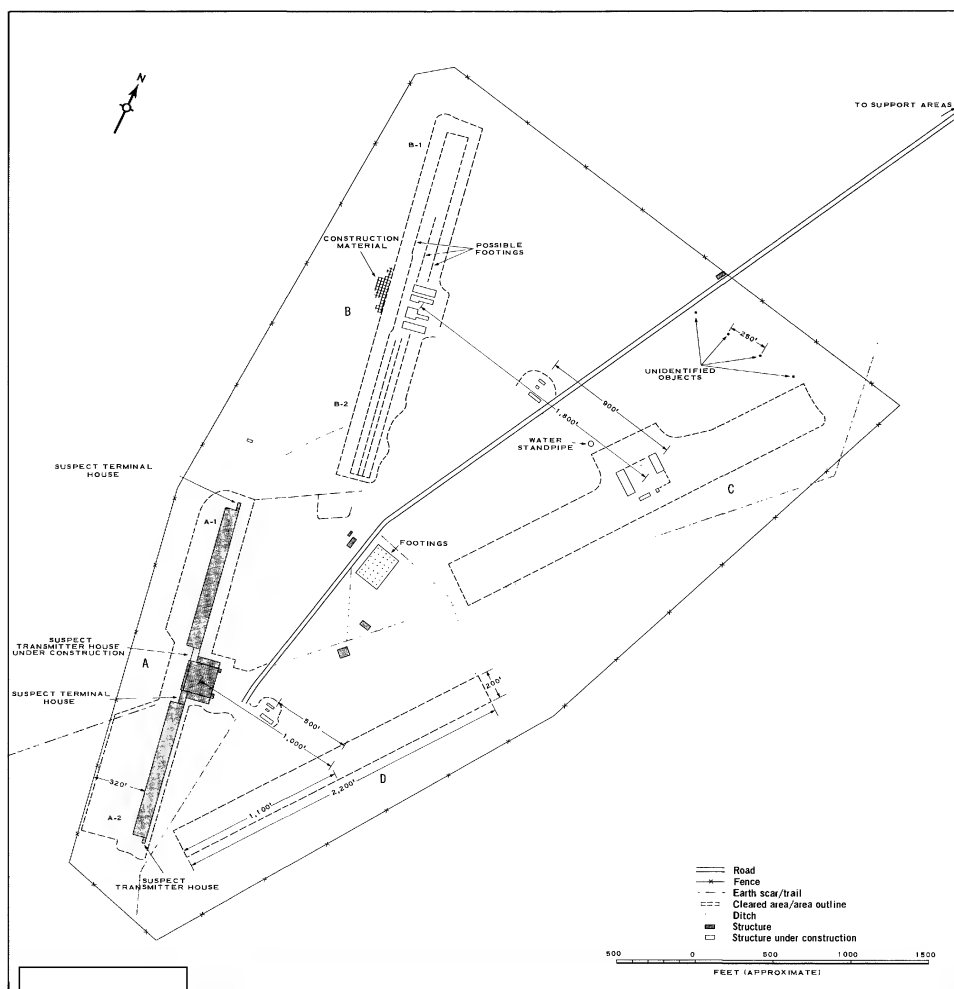


FIGURE 16. ANGARSK DUAL HEN HOUSE RADAR SITE OPERATIONS AREA

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building had been extended to the cleared area for Dual HEN HOUSE D (Note Figure 17).

25X1D HEN HOUSE Radar Antenna Structure A-1, a []
 25X1D [] structure, located north of the control building, has
 25X1D its long sides parallel to the eastern and western sides of
 25X1D the control building [] its southern end
 25X1D was separated from the main control building section by
 25X1D 85 feet (Figure 19). Photography [] reveals
 25X1D the possible addition of a small structure (suspect trans-
 25X1D mitter house) between the HEN HOUSE antenna structure
 25X1D and the control building. The western side of the HEN HOUSE
 antenna structure is approximately 40 feet forward of the
 control building.

It is suspected that the structure on the left side of a HEN HOUSE radar antenna structure is a transmitter house while the structure on the right side is a terminal house.

Photogrammetric analysis of [] coverage has confirmed that the pitch of the trusses is not similar, with the greatest angle of pitch being on the side facing west. Mensuration indicates that the slant height of the western side of each truss [] and the slant height of the eastern side []. Possible margins of error on these calculations are: up to a maximum of plus 15 feet for the western slope and down to a maximum of minus 15 feet for the eastern slope. Should the maximum possible error be applied to each side, the ridgeline would still be located west

of the central longitudinal axis of this structure. Photo quality and available information did not permit computation of the structure height or the angles of elevation of the pitched roof. However, the ridgeline appears to be over a line located approximately two-thirds the distance of the building width, and west of the central longitudinal axis of the structure (Figure 21).

The ridge of the HEN HOUSE structure appears to be approximately 2.5 times higher than the roof of the control building.

Photography [] revealed 44 trusses, spaced approximately 20 feet apart, erected over 860 feet of the structure's length, with probably 2 trusses still to be erected on the north end (Figure 19). [] roofing material covered approximately 3.5 structural bays east of the ridgeline, as shown in Figures 19 and 20. A dark striation could be seen through the trusses, running most of the length of the structure and located parallel to and approximately [] from the east side of the structure. Location of the striation is shown in Figure 21. Photography [] reveals that the roof probably has been covered and that a small structure (suspect terminal house) probably has been added to the north end of the HEN HOUSE.

Photography [] revealed that the front vertical section of HEN HOUSE A-1 probably is higher than the vertical front section of A-2; thus the boresight angle of elevation of the antenna face on HEN HOUSE A-1 probably is greater than the boresight angle of elevation at HEN HOUSE A-2. This correlates with the mensuration performed on Dual HEN HOUSE A at Sary-Shagan Site 13. Note Figure 6. Three different tones of gray could be seen in the vertical wall below the face at HEN HOUSE A-1. Two tones of gray could be seen on the inclined face of HEN HOUSE A-2 (See Figure 18). This tonal difference indicates that construction work probably continues at this installation.

[] the footings for HEN HOUSE Radar Antenna Structure A-2, located south of the control building, indicated it would be similar in size to antenna structure A-1 to the north. Dimensions and locations of footing with reference to the control building are shown in the rectified line drawing in Figure 19. A 45-foot wall for a suspect transmitter house is located just off the south end of the footings at HEN HOUSE A-2. It probably will be similar to structures

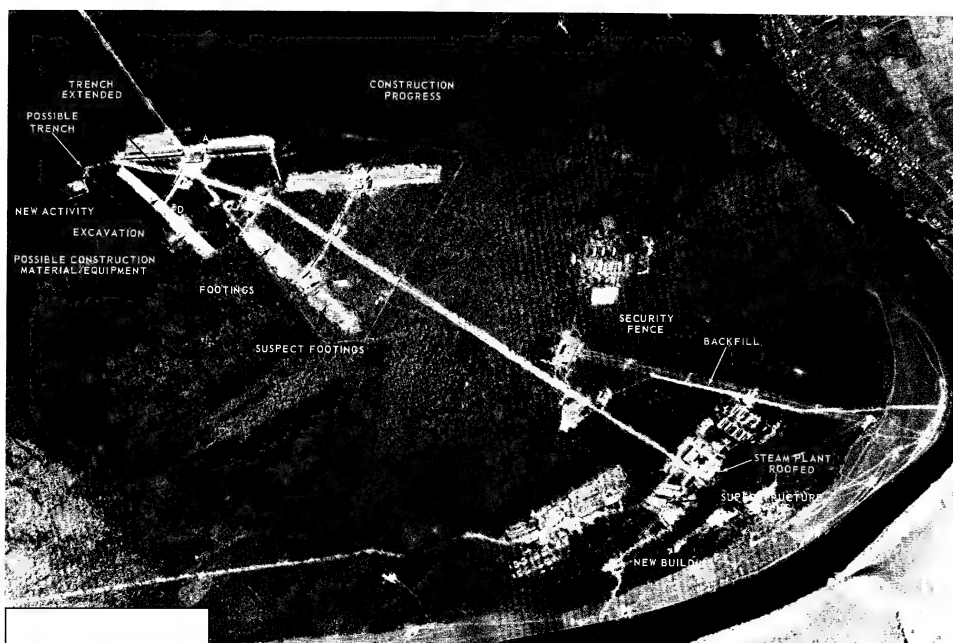


FIGURE 17. ANGARSK DUAL HEN HOUSE RADAR SITE, SHOWING CONSTRUCTION PROGRESS.

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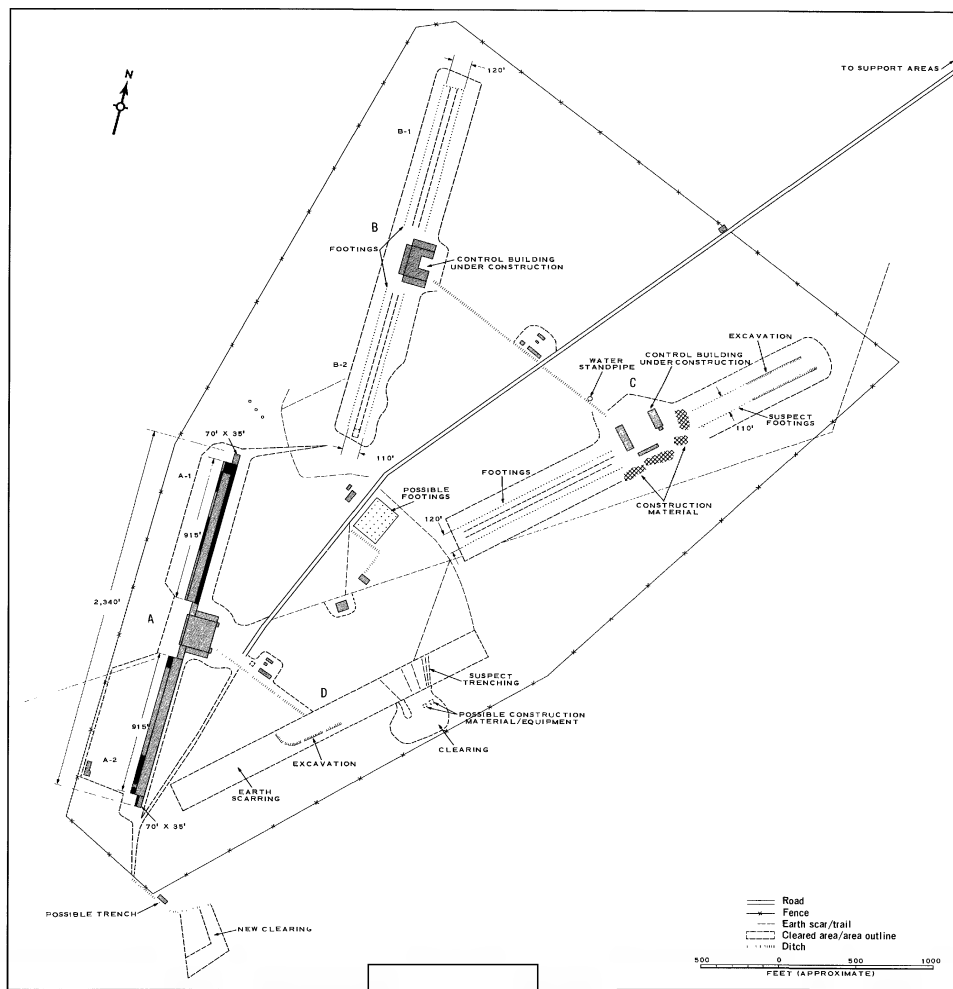


FIGURE 18. ANGARSK DUAL HEN HOUSE RADAR SITE OPERATIONS AREA

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which appear off each end of both HEN HOUSE structures at Dual HEN HOUSE A at Sary-Shagan Site 13. Three roughly circular possible excavations, with small unidentified objects centered inside, were located between the antenna structure foundation and the control building. Note Figures 19 and 20. The location of these features corresponds to the location of a suspect terminal house which is located between the HEN HOUSE structure and the control building at Dual HEN HOUSE A, Sary-Shagan Site 13. Photography reveals the possible addition of a suspect terminal house between HEN HOUSE A-2 and the control building.

Within the outer row of column footings and parallel to them is a line of possible footings and footing holes, arranged in a straight line and spaced approximately 10 feet apart. This inner row of possible footings is not centered but is approximately from the eastern row of column footings.

Internal suspect feed-associated structures ("piano keys"), roughly grid-shaped striations and other scars, can be seen along the length of the structure. These are shown in the line drawing on Figure 19. Photography revealed that the superstructure had been erected and that probably some roofing material was being applied.

Photography revealed that approximately 30 percent of the HEN HOUSE A-2 face is black.

Dual HEN HOUSE B. Dual HEN HOUSE B, located north of Dual HEN HOUSE A, is in an earlier stage of construction. It consisted of a cleared area approximately 2,400 by 300 feet, in the center of which a control building was in early stages of construction. A large amount of construction material was stacked in the area west of the control building and in the cleared area to the south (Figure 15). Initial excavation activity had commenced in the southern end of the cleared area south of the control building. Photography reveals excavation and possible excavations for both HEN HOUSE structures and construction progress on the control building.

Photography revealed further construction progress. "Piano keys" could be detected inside the footings for HEN HOUSE B-2, and possible

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footings for "piano key channels" could be detected inside footings for HEN HOUSE B-1. Possible footings for a suspect transmitter house off the southern end of B-2 appeared in approximate alignment with the footings for the internal "piano key channel".

The control building at Dual HEN HOUSE B is oriented in a manner similar to that of the Dual HEN HOUSE A control building, and probably will have a similar configuration. Although photography does not resolve the walls of the west and south wings were being erected and a small portion of the roof on the south wing was in place. The west wing appeared to be divided internally by 2 walls. Note Figure 22.

The extreme ends of the narrow west wing were either covered by a 5-foot wide strip of roofing, or the walls at this point are 5 feet thick. The south wing of the control building had a

section of its roof in place while a section, noticeably lower than the roof, protruded as shown in Figure 22.

Figure 22 shows the appearance of the control building at B

Although photography does not resolve the small and narrow west wing, it reveals that superstructure and roof on the north and south wing have been erected and that construction on the large central section is progressing.

areas for both HEN HOUSE structures at B were cleared and initial excavation activity was visible south of the control building construction. Photography reveals excavation and possible footings at both HEN HOUSE B sites.

Dual HEN HOUSE C. This installation is least advanced

of the 3 Dual HEN HOUSE installations being constructed in the operations area concrete footings for the control building were in place and stacks of construction materials were lying on the ground in the vicinity (Figure 15). The pattern formed by the control building footings strongly suggests that the control building for Dual HEN HOUSE C will have the same dimensions and configuration as the control building at Dual HEN HOUSE A. This was partially confirmed by the coverage, which revealed the superstructure of the narrow, probably wing and the other 2 wings being erected.

The cleared area on each side of the control building construction is sufficiently large to accommodate HEN HOUSE-type radar antenna structures; however, as of there was no sign of excavation activity in the cleared area. Photography revealed that excavation for the HEN HOUSE foundations had begun.

Figure 22 reveals the appearance of the control building at Dual HEN HOUSE C

The distance between footings for HEN HOUSE C-1 and C-2 and the location of possible footings for "piano key" channels at C-2, suggests that Dual HEN HOUSE C probably will be more nearly similar to Dual HEN HOUSE B than it will be to Dual HEN HOUSE A.

Dual HEN HOUSE D. The approximately 2,200- by 200-foot clearing for probable Dual HEN HOUSE D is located south of Dual HEN HOUSE C and east of Dual HEN HOUSE A. The long axis of this clearing is parallel to the long axis of Dual HEN HOUSE C. The appearance of this clearing gives the entire operations area a double V or chevron configuration.

Other Structures and Activity in the Operations Area. a number of foundations containing footings for unidentified structures were located in the approximate center of the operations area (see annotations 6 through 9, Figure 15). A standpipe with a capacity of approximately 153,000 U.S. gallons was seen just west of the control house construction at Dual HEN HOUSE C; however, there was no evidence of connecting pipelines

Photography revealed earth scars connecting the 2 control buildings at Dual HEN HOUSE B

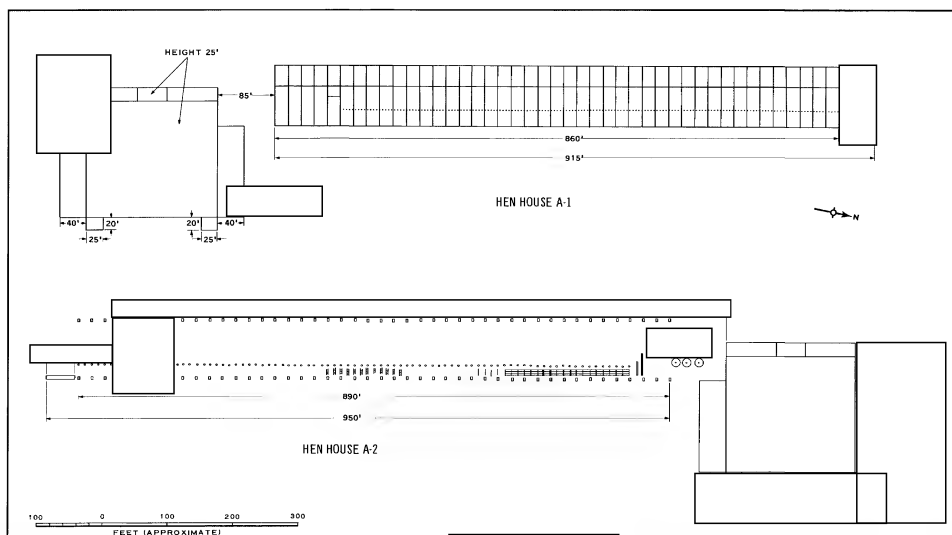


FIGURE 19. DUAL HEN HOUSE A, ANGARSK. Rectified line drawing.

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and C and possibly the standpipe located just west of the Dual HEN HOUSE C control buildings. Earth scars also connect the control building at Dual HEN HOUSE A and construction activity located between the control house and the center of the cleared strip for Dual HEN HOUSE D.

This construction activity, new [redacted] consists of a cleared area measuring approximately 190 by 150 feet and containing probable footings and some superstructure. Figure 23 shows the appearance of superstructure visible [redacted]

Approximately similar construction activity, also new [redacted] is located halfway between the control building of Dual HEN HOUSE B and Dual HEN HOUSE C, and adjacent to the connecting earth scar.

Photography [redacted] revealed that the probable trench from Dual HEN HOUSE A control building had been extended to the area of Dual HEN HOUSE D excavation activities (Figures 17 and 18).

The approximate distance between the center of the control building at Dual HEN HOUSE A and the center of the cleared area for probable Dual HEN HOUSE D is 1,000 feet. The corresponding distance between the control buildings at Dual HEN HOUSES B and C is 1,800 feet.

The Support Areas. Figure 13 shows the relationship of support areas to the operations area and Figure 24 is a line drawing of all 3 support areas with information regarding floorspace and construction progress.

The buildings in Support Area 1, Support Area 3,

and the western half of Support Area 2 appear to be wooden, temporary-type barracks and associated buildings. No effort has been made to construct a surfaced road to Support Area 1 or to the western half of Support Area 2. Though track activity indicates that access to these building areas has been primarily by foot, it also reveals that vehicles probably have been in these areas.

Intensive construction activity is visible in the central and southeastern end of Support Area 2. Two, and possibly 3, tower-type construction cranes were photographed in the area [redacted]. One was located adjacent to the construction activity in the steamplant area, and the second, and a possible third were at work in the multi-story building construction area. The dark buildings shown on line drawings in Figures 13 and 24 represent buildings which were either complete or had walls and roof in place [redacted]. The structures outlined and not filled in represent buildings in earlier stages of construction, some with only footings in place. Most of the buildings in the central and southeastern half of Support Area 2 appear to be permanent-type buildings and construc-

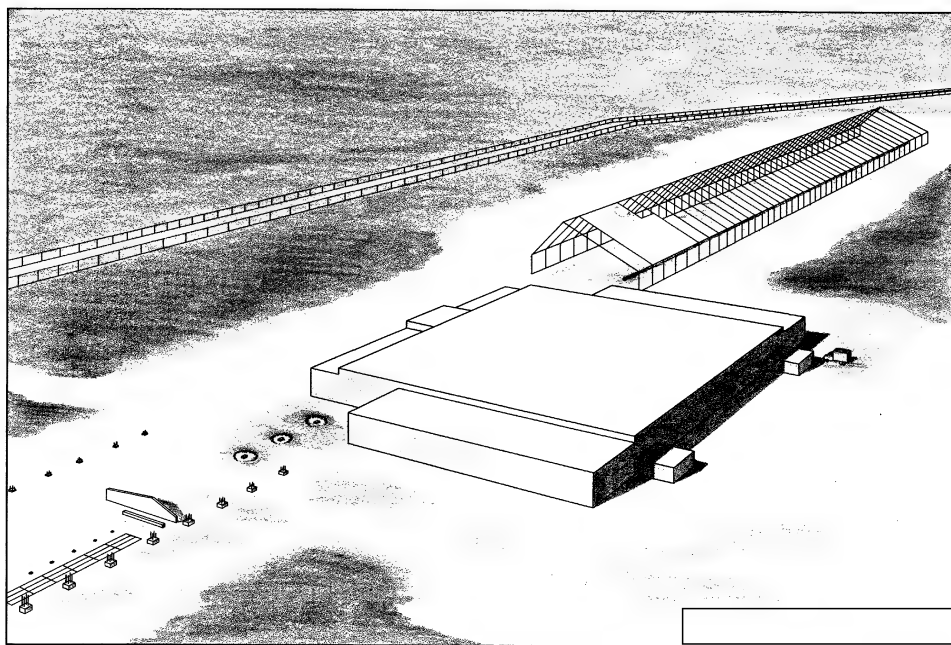


FIGURE 20. PERSPECTIVE OF DUAL HEN HOUSE A, ANGARSK

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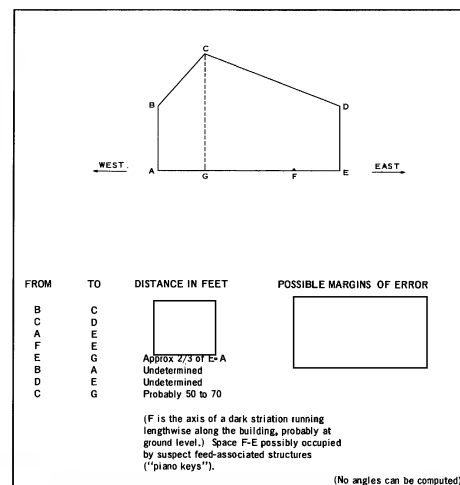


FIGURE 21. SIDE ELEVATION OF HEN HOUSE A-1, ANGARSK

FROM	TO	DISTANCE IN FEET	POSSIBLE MARGINS OF ERROR
B	C	<div>Approx 2/3 of E-A Undetermined Undetermined Probably 50 to 70</div>	<div>(No angles can be computed)</div>
C	D		
A	E		
F	G		
E	G		
B	A	Undetermined	
D	E	Undetermined	
C	G	Probably 50 to 70	

(F is the axis of a dark striation running lengthwise along the building, probably at ground level.) Space F-E possibly occupied by suspect feed-associated structures ("piano keys").

(No angles can be computed)

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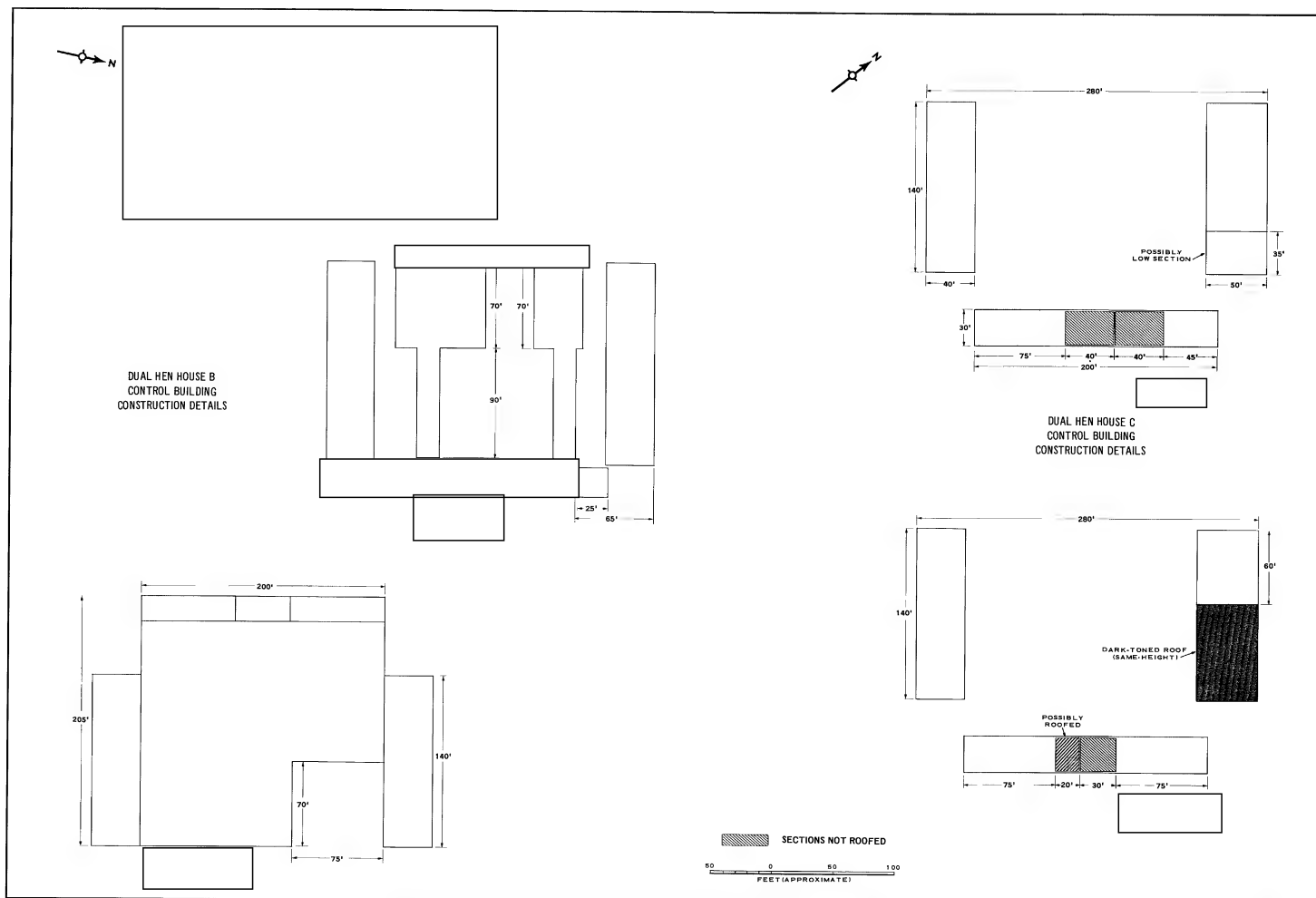


FIGURE 22. CONTROL BUILDINGS AT DUAL HEN HOUSES B AND C, ANGARSK. Construction progress.

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tion activity continues on and near most of them. Trenches, construction materials, and approximately 20 vehicles could be seen in the area [redacted] Photography [redacted] reveals progress in Support Area 2. Superstructure is now visible on the steamplant, 2 adjacent structures and an additional multistory permanent probable quarters in the southeastern end of Support Area 2. Photography [redacted] revealed that approximately 6 buildings in Support Area 2, which were previously in early stage of construction, now appear externally complete. They include the steamplant and 1 of the multistory probable quarters. Superstructure on the easternmost multistory probable quarters is now being erected. Some of the trench for the water pipeline has been backfilled and a security fence can be detected around the electric power transformer substation.

The following figures reveal the probable personnel complement of the Angarsk Dual HEN HOUSE Radar Site. It was assumed the uncompleted apartment-type buildings would have the same capacity as those completed:

Personnel Accommodated				
Type	Floor Space	At 70 sq ft per person	At 100 sq ft per person	At 130 sq ft per person
Barracks	136,300	1,950	1,360	
Apartments	119,200			915
Total	225,500			
Probable minimum accommodation: 2,375 personnel				
Probable maximum accommodation: 2,865 personnel				

These figures need not necessarily represent a true picture of the total number of operational and support personnel at the site following its completion. It is possible that many of the barracks-type quarters were initially erected to house construction personnel, and may be dismantled or used for other purposes following completion of the project.

Azimuths of Propagation

Analysis of correlations between the configuration and size of Angarsk HEN HOUSE A-1 (See Figures 19, 20, and 21) and the prototype HEN HOUSE at Sary-Shagan Radar Site 1 permitted identification of the west side of Angarsk HEN HOUSE A-1 as probably the antenna face side.

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Initial analysis of the footings at Angarsk HEN HOUSE A-2 resulted in a hypothesis that the internal footings might be located directly under the ridgeline of the HEN HOUSE structure. This suggested that the antenna face on HEN HOUSE A-2 might face to the east. Though this supposition seemed to be further supported by the linear non-alignment of excavations seen [redacted] there were considerations which did not support this hypothesis. Further analysis of the Angarsk [redacted] coverage [redacted] revealed a dark striation along the length of and probably inside HEN HOUSE A-1. It was located approximately the same distance from the east side of the structure as the distance separating the 2 easternmost rows of footings at HEN HOUSE A-2. If this striation corresponds to the internal footings at A-2, it would follow that the internal footings at HEN HOUSE A-2 need not necessarily fall under the ridgeline.

An important consideration is masking. If Angarsk HEN HOUSE A-2 were to propagate in an easterly direction, Dual HEN HOUSE C would cause interference. Furthermore, if similar construction at all other Dual HEN HOUSEs were to follow, it seems that serious masking problems would probably be experienced there as well.

If both antenna faces at Angarsk Dual HEN HOUSE A were on the west side of their respective structures, there would be no masking problem. Assuming that this will indeed be the method of construction, other Angarsk installations were examined to determine possible correlations, assuming their construction pattern would be similar to Installation A. This examination revealed that it would be reasonable to expect that both HEN HOUSE antennas would be on the same side and have their boresight azimuths in parallel planes.

The face side of HEN HOUSE structures probably can be predicted by noting the position of the control house with reference to a line joining the 2 HEN HOUSE structures. Thus, if the face of each antenna at Angarsk Dual HEN HOUSE A is on the west side, the entire control building would be to the rear of all propagating surfaces. If the same concept of construction is being followed at Sary-Shagan Site 13 (and it is at Dual HEN HOUSE A, as revealed by photography [redacted] one can postulate that Dual HEN HOUSEs at Angarsk will have their antenna faces on corresponding sides, having similar boresight azimuths in

parallel planes. This postulation is reasonable because, in each case, the side of the structure likely to receive the face would be in front of the control building. This also would eliminate masking problems from adjacent structures. Photography of the Angarsk site [redacted] provides confirmation that the antenna faces on Dual HEN HOUSE A-1 and A-2 are on the west side of the structure.

Consequently, it is believed that boresight azimuths at all Dual HEN HOUSE antennas will probably be as follows: (Also see Figures 11, 15, and 25).

Site Location	HEN HOUSE	Boresight Azimuth
Angarsk	A-1 A-2	260 (confirmed)
	B-1 B-2	260 (probable)
Sary-Shagan	C-1, C-2, D-1, D-2	[redacted]
	A-1 A-2	
Olenegorsk	C-1 C-2	[redacted]
	A-1 A-2	

Figure 26 shows the location of azimuths with reference to each site and other geographic features, plotted on a gnomonic chart. (*) In addition to the azimuths from

*A straight line on a gnomonic chart represents a great circle arc.

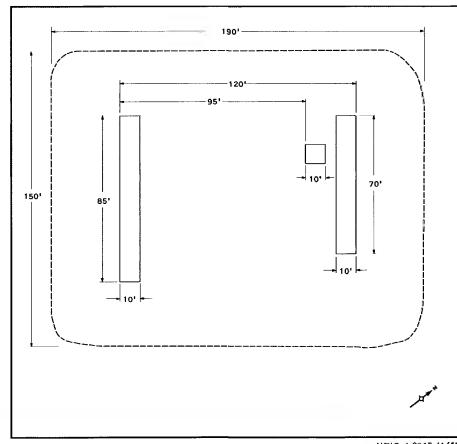


FIGURE 23. UNIDENTIFIED STRUCTURES UNDER CONSTRUCTION CENTERED BETWEEN CONTROL BUILDINGS AT ANGARKS DUAL HEN HOUSE RADAR SITE.

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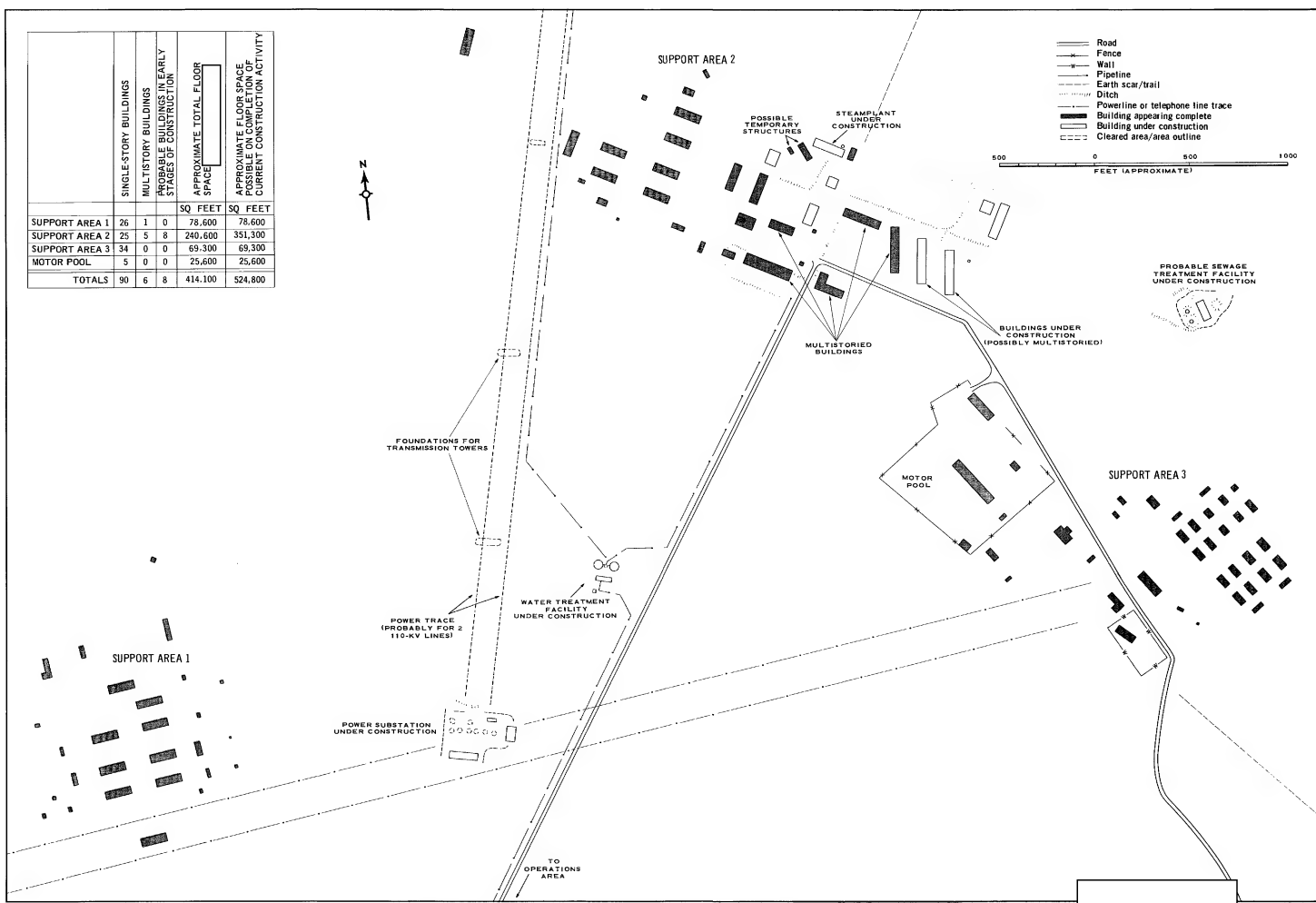


FIGURE 24. ANGARSK DUAL HEN HOUSE RADAR SITE SUPPORT AREA

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Dual HEN HOUSE installations, this map also shows the boresight azimuth from the prototype HEN HOUSE at Sary-Shagan Radar Site 1 and the possible azimuth from the Moscow DOG HOUSE possible phased-array radar, assuming that both faces of the DOG HOUSE will contain radar antennas.

Though these azimuths have been computed to an [REDACTED] most of them are only probable azimuths until photographic or other evidence can confirm the location of each antenna face. Consequently, for research purposes, a list of geographic coordinates along each conceivable azimuth from the HEN HOUSE structures is attached as Tables 1 through 12, pages 31 to 35. These geographic coordinates have been computer-determined at regular intervals along each of the listed azimuths, for a distance of approximately 5,000 nm from the given installation.

Geographic coordinates along both boresight azimuths from the DOG HOUSE also have been computer-determined and are included as Tables 14 and 15. The computer-produced coordinates were checked by solving reverse problems. Additional computer checks determined azimuths, given the previously computed coordinates.

A study of Figure 26 reveals that boresight azimuths (and some back azimuths) go near or through certain related installations. For example, the boresight azimuth from Angarsk Dual HEN HOUSEs A and B passes very close to Sary-Shagan and that from Sary-Shagan Dual HEN HOUSE C passes close to Angarsk. Consequently, a second computer analysis was initiated to determine the exact distances and azimuths between possibly related points. Table 16 shows the result of this computer analysis.

A study of these azimuths shows that there is a high degree of probability that:

- (1) Angarsk Dual HEN HOUSEs A and B are oriented to place their probable boresight azimuth through Sary-Shagan Site 13.
- (2) Sary-Shagan Dual HEN HOUSEs A and B are oriented to place their possible boresight azimuths through Tyuratam Missile Test Center.
- (3) Sary-Shagan Dual HEN HOUSE C is oriented to place its possible boresight azimuth through the Angarsk

Dual HEN HOUSE Radar Site.

- (4) Olenegorsk HEN HOUSE A-2 is oriented to place its possible back azimuth through Sary-Shagan Site 13.

If we hypothesize that the above probabilities are indeed fact, then one of the following conclusions could be accepted as correct:

- (1) The Soviets surveyed these installations accurately, to have the boresight azimuths line up as suggested in the previously stated probabilities and the azimuths computed for Figure 26 have a slightly higher margin of error than supposed.

- (2) The azimuths computed for Figure 26 are accurate [REDACTED] and the Soviets did not survey these installations accurately (assuming an intent to have boresight azimuths line up as suggested above).

- (3) The azimuths computed for Figure 26 are accurate [REDACTED] the Soviets surveyed their installations accurately, and the proximity of boresight azimuths to the listed installations is simply coincidental (implying no intention to line up the boresight azimuths exactly with the given installations).

- (4) The azimuths compiled for Figure 26 are accurate [REDACTED] the Soviets surveyed the installations accurately, to have the boresight azimuths line up approximately as suggested in the above stated probabilities (implying no intention to have pinpointed accuracy).

Of the 4 possible conclusions listed, the first and the fourth appear to be the most reasonable.

DISCUSSION

Type of Radar

It is generally believed that the HENHOUSE structures house some type of phased-array radar. As the result of one hypothesis, it is suspected that 1 of the small structures attached to the end of a Dual HENHOUSE serves as a transmitter house and the other as a terminal house. It is possible that such an arrangement would be compatible with a frequency-scanned phased-array radar.

Another hypothesis concludes that the bulk of the HEN HOUSE structure behind the face suggests the use of an array of lenses in the antenna face, with the feed elements

mounted internally a given distance behind each of the lens panels. The internal footings and suspect internal feed-associated structures ("piano keys") seen at the various HEN HOUSEs under construction must be studied carefully by antenna engineers (Figure 27). Special care must be taken to note the correlation between the size, spacing and positions of the "piano keys" and the size and location of the relatively small buildings on each end of the HEN HOUSE structures. Further correlation to boresight angles of elevation will be most important.

The appearance of this internal construction at the various HEN HOUSEs somewhat resembles the appearance of suspect feed-associated structures which were revealed in front of the northern HEN ROOST antenna (Sary-Shagan Radar Site Number 2) by [REDACTED] photography [REDACTED]

[REDACTED] See Figure 28 which contains a photo analyst's impression of the "piano key"-type structure between the HEN ROOST antenna and the ground clutter screen to the west. It is not possible to confirm whether these structures still are located in front of the HEN ROOST antenna; however, some of the best and most recent [REDACTED] photography (HEN ROOST has not yet been covered by large-scale [REDACTED] photography) reveals a faint light-toned striation in front of the HEN ROOST antenna, suggesting the possibility that some portion of these structures still remains (Figure 29).

[REDACTED] photography of the HEN ROOST was used to compute the angles shown in Figure 28. Distances were measured on current, good-quality [REDACTED] photography.

The size of the original panels at Sary-Shagan's prototype HEN HOUSE was approximately 40 by 20 feet, according to analysis of [REDACTED] photography [REDACTED] Photography [REDACTED] revealed that possibly larger panels were being installed (Figure 3). Because of the limitations imposed by relatively poor ground resolution the dimensions shown must be considered approximate only. The fact that a space can be detected between 6 separate panels would at first suggest that the distance between panels must be between 10 and 20 feet, the probable range of ground resolution for this coverage. However, linearity (considering a probable panel length of 40 feet) would make it possible to detect a smaller separation. The numerical coefficient in this relationship is not known. Though the confidence in panel width measurements is relatively low, it is nevertheless interesting to note the

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metric system measurements derived. Later photography permitting more detailed analysis revealed the entire face as black; however, individual panels could not be detected. This suggests 1 of 3 possibilities:

- (1) Wider panels were installed, with distance between panels too small for photo resolution.
- (2) Wider panels were installed with no space between panels.
- (3) The entire face was covered by a continuous sheet of dark material.

Size and Configuration of HEN HOUSE Structures

A study of line drawings and dimensions reveals that probably at least 2 different modifications of the Dual HEN HOUSE installations are being constructed, though the control house in each case appears similar in shape and size. These different modifications are possibly related to the requirements of propagating radar energy along different boresight angles of elevation. However, boresight angles of elevation at Sary-Shagan Dual HEN HOUSE A are different at each of the HEN HOUSE radar faces, despite the fact that the HEN HOUSE structures and probably their "piano key" channels are similar in size and placement. The same is probably true at Angarsk Dual HEN HOUSE A.

For purposes of discussion the 2 modifications can be called "FAT-BOY" and "THIN-BOY." In the case of the THIN-BOY variety, both HEN HOUSE antenna structures are generally similar in size, both being approximately 100 feet in width, or less. In addition, THIN-BOY HEN HOUSES have their internal suspect feed-associated structures (piano keys) against the rear wall of the HEN HOUSE structure. The piano key channels in both THIN-BOY HEN HOUSE structures are probably similar in width, though they are markedly smaller than the piano key features at FAT-BOY HEN HOUSES. Suspect transmitter and terminal houses at THIN-BOY HEN HOUSES are smaller than the corresponding structures attached to FAT-BOY HEN HOUSES (Figure 7).

In the case of FAT-BOY HEN HOUSES, the HEN HOUSE structure on each side of the control building differs in width, 1 being approximately 110 feet wide, the other approximately

135 feet wide. The width of the piano key channel possibly differs and the channels are positioned a markedly different distance from the rear of their respective HEN HOUSE enclosures. Therefore it is suspected that boresight angles of elevation on FAT-BOY HEN HOUSES might be sufficiently elevated to permit the vertical beaver tail propagation pattern to extend beyond the zenith along the back azimuth.

Dual HEN HOUSE A at Angarsk and Sary-Shagan are of the THIN-BOY variety, with suspect transmitter and terminal houses lined up with the row of internal suspect feed-associated structures (piano keys) which are positioned against the inside rear wall of the HEN HOUSE structure.

The following Dual HEN HOUSE radars are of the FAT-BOY variety:

Sary-Shagan Site 13	Dual HEN HOUSE B
Sary-Shagan Site 13	Dual HEN HOUSE C
Probably Angarsk Dual HEN HOUSE B	
Probably Angarsk Dual HEN HOUSE C	

It is suspected that Dual HEN HOUSE D at Angarsk and at Sary-Shagan Site 13 will be of the THIN-BOY variety in view of the pattern established to date.

Both HEN HOUSE structures at Olenegorsk are probably of the THIN-BOY variety, based on the width of the HEN HOUSE antenna structure, the alignment of suspect transmitter and terminal houses with the rear of the HEN HOUSE structure, and the possible placement of internal feed-associated structures against the rear wall of the HEN HOUSE.

Function of the Dual HEN HOUSES

The locations of the Dual HEN HOUSE sites at Angarsk and at Sary-Shagan suggest that these installations are possibly part of a satellite radar fence. The prototype HEN HOUSE at Sary-Shagan Radar Site 1 was the research and development version; therefore, it is hardly likely that the extensive Dual HEN HOUSE installations at Sary-Shagan and northwest of Angarsk would be for research and development purposes. Their location does not appear optimum for an early warning role against ballistic missiles.

The [] azimuth from Sary-Shagan Site 13 passes through Launch Complex A at Tyuratam and the [] azimuth passes within 250 and 275 nm of the centers of Soviet Pacific Impact Areas 1 and 2, respectively.

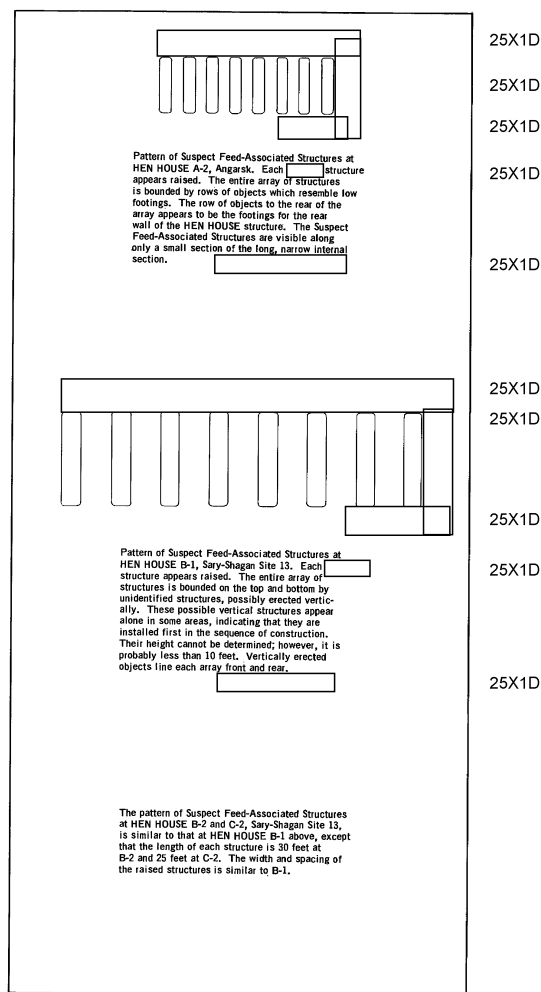


FIGURE 27. SUSPECT FEED-ASSOCIATED STRUCTURES, SSATC AND ANGARKS.

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25X1

25X1D

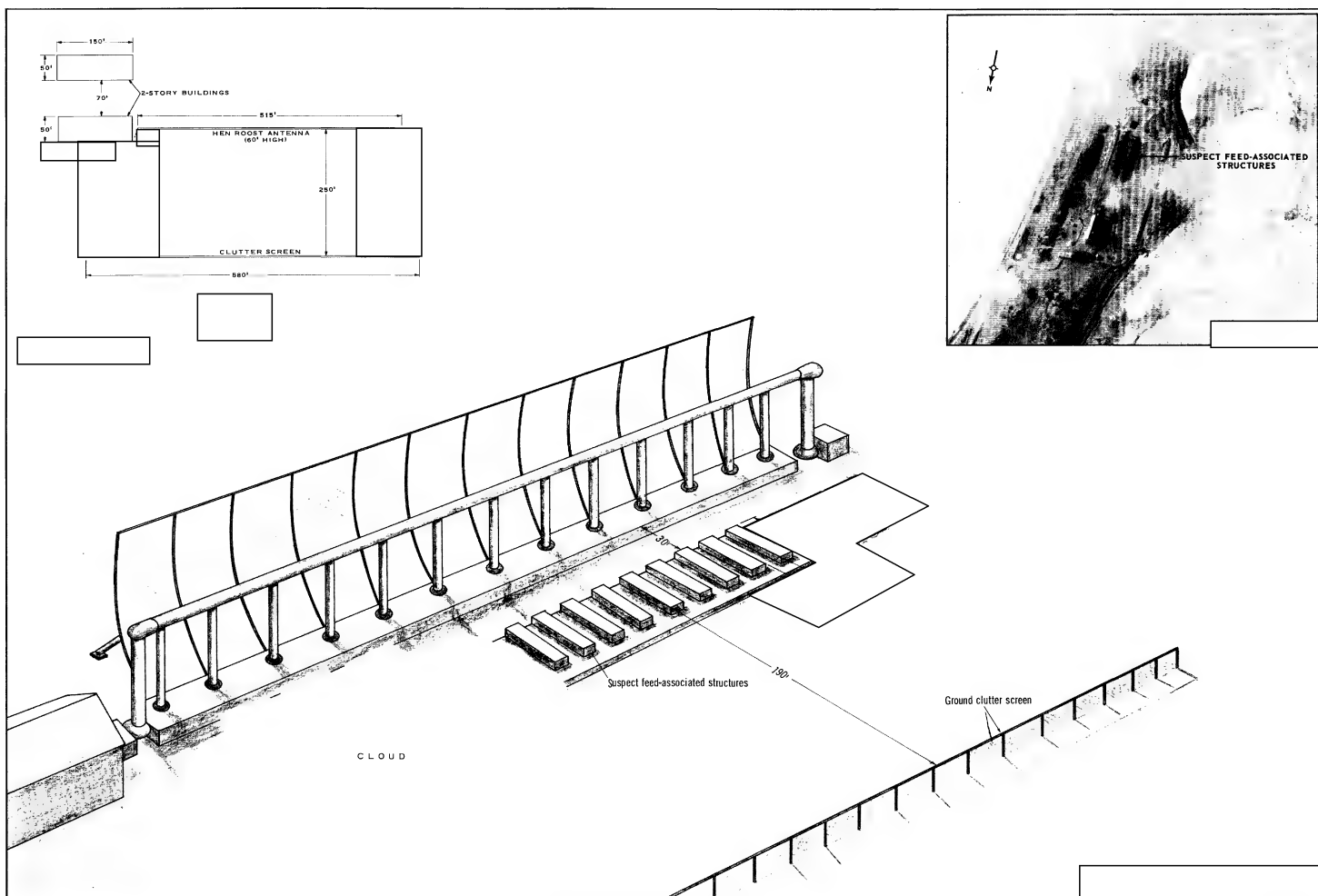
25X1D

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25X1D



25X1D

25X1D

25X1D

FIGURE 28. HEN ROOST RADAR, SSATC.

NPIC J-9220 (4/85)

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25X1
JX1

25X1D These impact areas are approximately 900 and 600 nm south-southeast of Johnston Island. These facts suggest a possibility that Sary-Shagan Site 13 Dual HEN HOUSEs might also be employed in the Soviet space and ICBM test program.

25X1D The location of the Olenegorsk Dual HEN HOUSE facility, with its probable azimuths of propagation shown on Figures 11 and 26, suggests a dual role: ballistic missile early warning and anti-satellite radar fence.

25X1D

25X1B

25X1D

stallation B, [] photography revealed a straight earth scar between the building triad area and the vicinity of construction on the control building of Dual HEN HOUSE B. See graphic chronology of earth scars in Figure 8. This earth scar still was very prominent [] It appeared to run from an area adjacent to the south side of the large building in the triad toward the control building at Dual HEN HOUSE B. It is suspected that this scar is a buried conduit to the control house, passing under the road which runs behind the HEN HOUSE construction. [] a straight earth scar could be seen leading toward the Dual HEN HOUSE B construction from the north side of the large building in the triad. Partial cloud cover did not permit observing its terminus. The same mission revealed a straight earth scar south of the entire triad, oriented approximately east-west and skirting the southern side of the southernmost small building of the triad. Photography [] confirmed the presence of the 2 scars seen [] The scar seen leaving the area adjacent to the south side of the large triad building [] could no longer be detected [] The shorter of the 2 scars still visible has its termini at points south of the large triad building and southeast of Dual HEN HOUSE B control building. It is possible these earth scars are simply signatures of buried water, steam or electric power lines. They could, however, signify some sort of functional interdependence. Enclosing the Dual HEN HOUSEs and the triad facility behind the same double security fence, in itself, does not prove functional interdependence; however, it is important evidence to consider.

Perhaps the most critical evidence regarding the possible relationship of the building triad to the Dual HEN HOUSE at Sary-Shagan concerns chronology of electric powerline installations (Figure 30). Electric power transmission lines leading from the Balkhash area toward the Sary-Shagan Main Support Base and Gulshat were tapped and towers for overhead electric power transmission lines were installed in lines leading southward toward the Dual HEN HOUSE construction site. Transmission towers for a 35-kv line were first seen [] and negated [] Transmission towers for a 110-kv line were suspected in place [] confirmed []

[] The latter data 25X1D applies to the larger of the 2 electric power transformer substations located about 2 nm northwest of the central support area. Evidence of other overhead powerlines into Site 13 cannot be found; however evidence of power transmission or telecommunication poles can be detected leading into the water pumping station area from the town of Gulshat. Because of the extensive track activity between the pumping station and Sary-Shagan Site 13, and the limitations of available photography, an electric power transmission line cannot be negated between these 2 points. However, it is conceivable that electric power consumed at Sary-Shagan Site 13 [] was produced on site by internal combustion power generators. If on-site power generation would be inadequate for employment of the building triad it can be concluded that the triad at Sary-Shagan Site 13 has not yet been operational. Of interest is the fact that the transmission towers carrying electric power from the vicinity of the Main Support Base, by Radar Sites 1 and 2 down into Instrumentation Site 2, have a spacing and height which strongly suggest that 35-kv power lines are serving these installations. The same is true of transmission tower spacing for electric powerlines serving Launch Complex B and Instrumentation Site 10. At the same time it should be recalled that 110-kv powerlines are being installed into the Angarsk Dual HEN HOUSE Radar Site.

25X1D

25X1D

25X1D

25X1D

25X1D

25X1D

25X1D

Relationship of the Dual HEN HOUSEs and the Building Triad at Site 13, Sary-Shagan

A functional relationship between the building triad at Sary-Shagan Site 13 and the nearby Dual HEN HOUSE installations is probable, but cannot be confirmed.

The collocation of the building triad and the Dual HEN HOUSE installations is probably not coincidental. With the appearance of construction activity at Dual HEN HOUSE In-

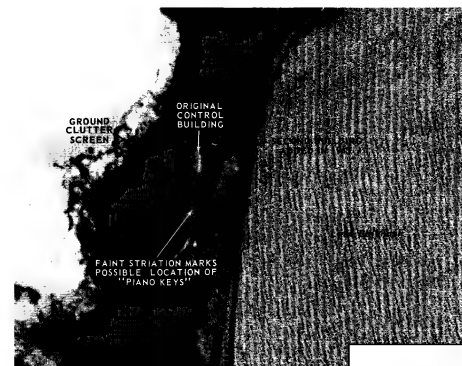


FIGURE 29. HEN ROOST NORTH, SSATC. NPIC J-8021 (4/68)

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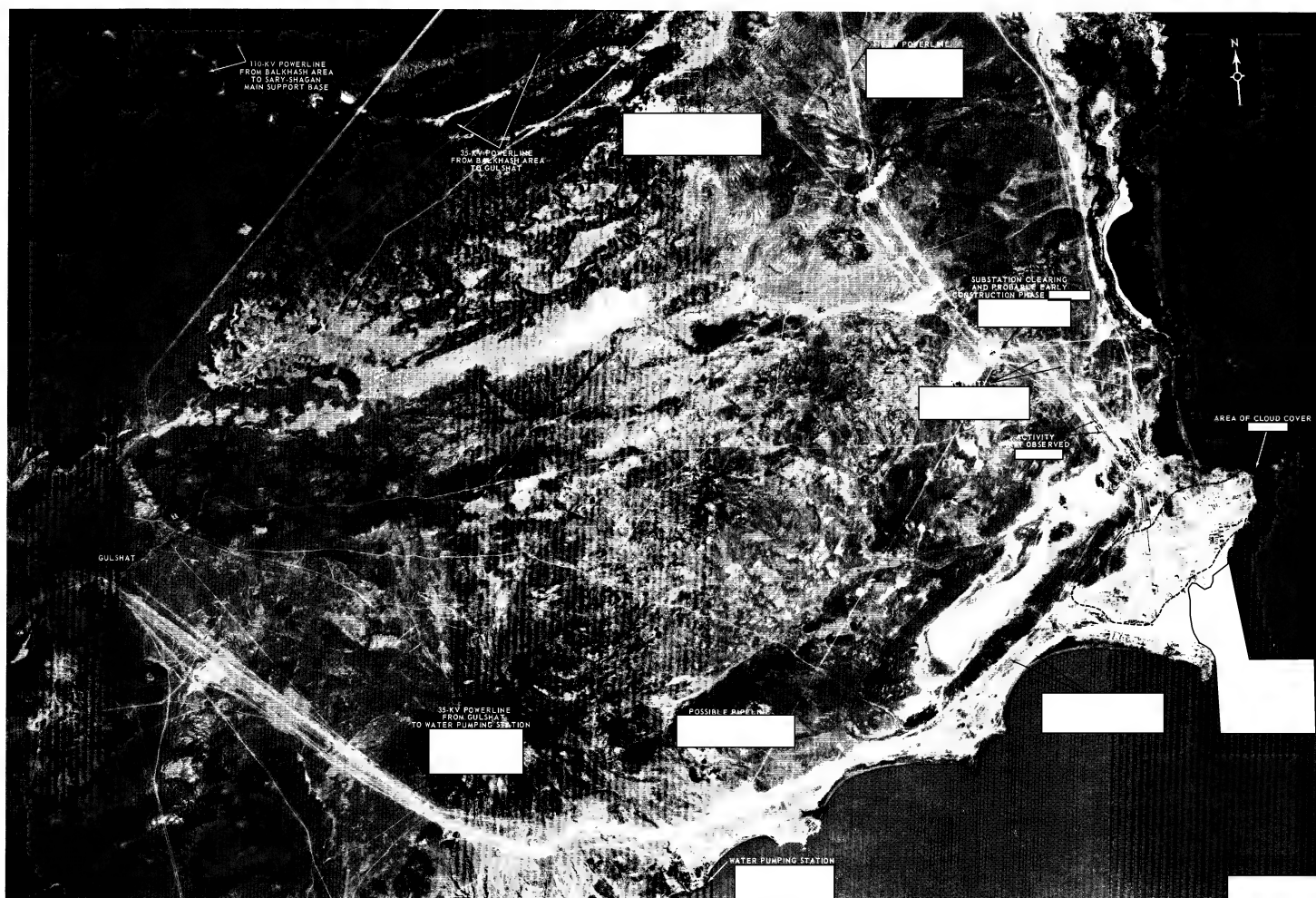


FIGURE 30. SSATC SITE 13 AND ASSOCIATED FEATURES.

NRIC J-9222 14/651

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Furthermore it should be remembered that all the other Sary-Shagan building triad sites contain other facilities which were completed before construction of the building triads was initiated. Consequently a possibility exists that the building triad installations, the prototype HEN HOUSE (Radar Site 1) and the HEN ROOST at Sary-Shagan are serviced with 35-kv electric power transmission lines while Dual HEN HOUSE sites require at least 110-kv service. At the present time it is not possible to determine if 1 or 2 110-kv lines will be feeding the Dual HEN HOUSE site at Sary-Shagan.

The building triads in the Moscow area have been considered possibly ABM-associated, though their use purely in an air defense role has been receiving consideration. Their presence at Sary-Shagan, which has been associated repeatedly with ABM and SAM activity, and their installation around Moscow, which was already heavily defended by a variety of SAM systems, necessitates retention of the term "possibly ABM-associated." In the case of Sary-Shagan Site 13, the possible functional relationship of the building triad facility to the Dual HEN HOUSE radar makes this particular triad a possible anti-satellite associated installation. Capabilities in anti-satellite and anti-ballistic missile roles are compatible; therefore, the above association at Sary-Shagan strengthens the confidence in an ABM designation for the building triad facilities in the Moscow area. Photography [] revealed the start of construction on a second set of building triads at SAM Site E33-1 and E05-1. This development, plus the extensive unidentified earth scarring, revetting, and digging which is taking place at numerous SA-1 sites around Moscow, strengthens the suspicion that the building triads are ABM associated.

Table 1. HEN HOUSE, Sary-Shagan Site 13. Geographic Coordinates Along [] Azimuth.*

Latitude o ' "	Longitude o ' "
46-35N	74-31E
46-30N	71-05E
46-21N	68-12E
46-07N	65-20E
45-49N	62-30E
45-27N	59-42E
45-01N	56-56E
44-31N	54-13E
43-57N	51-33E
43-20N	48-56E
42-39N	46-22E
41-54N	43-52E
41-07N	41-25E
40-16N	39-02E
39-22N	36-42E
38-26N	34-26E
37-27N	32-14E
36-26N	30-05E
35-22N	28-00E
34-17N	25-58E
33-09N	23-59E
32-00N	22-03E
30-48N	20-09E
29-35N	18-19E
28-21N	16-32E
27-05N	14-46E
25-48N	13-03E
24-30N	11-23E
23-11N	09-45E
21-50N	08-08E
20-29N	06-33E
19-07N	05-00E
17-44N	03-28E
16-20N	01-58E
14-56N	00-29E
13-31N	00-58W
12-05N	02-25W
10-40N	03-51W
09-13N	05-16W
07-47N	06-40W
06-20N	08-04W
04-09N	10-09W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 2. HEN HOUSE, Sary-Shagan Site 13. Geographic Coordinates Along [] Azimuth.*

Latitude o ' "	Longitude o ' "
46-35N	74-31E
46-35N	77-25E
46-30N	80-19E
46-21N	83-12E
46-08N	86-04E
45-51N	88-54E
45-29N	91-43E
45-03N	94-29E
44-33N	97-13E
44-00N	99-53E
43-23N	102-30E
42-42N	105-04E
41-58N	107-34E
41-10N	110-01E
40-20N	112-25E
39-26N	114-44E
38-30N	117-01E
37-32N	119-13E
36-30N	121-29E
35-27N	123-28E
34-22N	125-31E
33-14N	127-30E
32-05N	129-26E
30-54N	131-19E
29-41N	133-10E
28-27N	134-57E
27-11N	136-43E
25-54N	138-26E
24-36N	140-06E
23-16N	141-45E
21-56N	143-22E
20-35N	144-57E
19-13N	146-30E
17-50N	148-02E
16-26N	149-32E
15-02N	151-01E
13-37N	152-29E
12-12N	153-56E
10-46N	155-22E
09-19N	156-47E
07-53N	158-11E
05-28N	160-30E

*Coordinates at regular intervals from this site to a distance of approximately 5,000 nm.

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Table 3. HEN HOUSE, Sary-Shagan Instrumentation Site 13.
Geographic Coordinates Along [REDACTED] Azimuth.*

Latitude °	Longitude °
46-35N	74-31E
45-25N	71-49E
44-19N	69-29E
43-09N	67-13E
41-58N	65-03E
40-43N	62-58E
39-27N	60-57E
38-08N	59-01E
36-48N	57-08E
35-26N	55-20E
34-03N	53-35E
32-37N	51-54E
31-11N	50-16E
29-43N	48-41E
28-15N	47-08E
26-45N	45-38E
25-14N	44-11E
23-34N	42-32E
22-10N	41-22E
20-37N	40-00E
19-03N	38-40E
17-29N	37-22E
15-54N	36-04E
14-19N	34-48E
12-43N	33-33E
11-07N	32-19E
09-30N	31-06E
07-54N	29-54E
06-17N	28-42E
04-40N	27-30E
03-03N	26-19E
01-25N	25-08E
00-12S	23-57E
01-49S	22-46E
03-27S	21-35E
05-04S	20-24E
06-41S	19-13E
08-18S	18-00E
09-54S	16-48E
11-31S	15-34E
13-07S	14-20E
15-30S	12-27E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 4. HEN HOUSE, Sary-Shagan Instrumentation Site 13.
Geographic Coordinates Along [REDACTED] Azimuth.*

Latitude °	Longitude °
46-35N	74-31E
47-25N	77-03E
48-32N	79-41E
49-25N	82-24E
50-14N	85-14E
50-58N	88-09E
51-38N	91-09E
52-13N	94-14E
52-44N	97-24E
53-09N	100-38E
53-29N	103-56E
53-44N	107-16E
53-52N	110-38E
53-55N	114-01E
53-53N	117-24E
53-44N	120-46E
53-30N	124-06E
53-11N	127-24E
52-46N	130-38E
52-16N	133-48E
51-41N	136-54E
51-01N	139-54E
50-16N	142-49E
49-28N	145-39E
48-35N	148-23E
47-38N	151-01E
46-38N	153-33E
45-35N	156-00E
44-29N	158-21E
43-20N	160-37E
42-08N	162-48E
40-54N	164-54E
39-38N	166-55E
38-19N	168-52E
36-59N	170-44E
35-37N	172-33E
34-13N	174-19E
32-48N	176-01E
31-22N	177-39E
29-55N	179-13E
28-26N	179-14W
25-56N	176-45W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 5. HEN HOUSE, Olenegorsk. Geographic Coordinates
Along [REDACTED] Azimuth.*

Latitude °	Longitude °
68-54N	029-04E
69-32N	023-54E
70-00N	018-28E
70-18N	012-49E
70-26N	007-04E
70-22N	001-17E
70-07N	004-24W
69-42N	009-55W
69-06N	015-10W
68-22N	020-07W
67-30N	024-43W
66-30N	028-55W
65-24N	032-53W
64-12N	036-25W
62-55N	039-45W
61-35N	042-45W
60-10N	045-29W
58-43N	048-00W
57-13N	050-19W
55-40N	052-27W
54-06N	054-24W
52-29N	056-14W
50-52N	057-55W
49-12N	059-29W
47-32N	060-58W
45-51N	062-20W
44-08N	063-38W
42-25N	064-52W
40-41N	066-01W
38-56N	067-07W
37-11N	068-10W
35-25N	069-10W
33-39N	070-08W
31-52N	071-03W
30-05N	071-56W
28-18N	072-47W
26-20N	073-36W
24-42N	074-24W
22-54N	075-11W
21-05N	075-56W
19-17N	076-40W
18-04N	077-09W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

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25X1

25X1D

Table 6. HEN HOUSE, Olenegorsk. Geographic Coordinates
Along [] Azimuth.*

Latitude ° ' "	Longitude ° ' "
69-42N	030-47E
71-13N	027-10E
72-39N	022-58E
73-59N	018-03E
75-11N	012-19E
76-13N	005-41E
77-03N	001-54W
77-38N	010-30W
77-56N	019-24W
77-56N	028-41W
77-38N	037-44W
77-03N	046-10W
76-13N	053-45W
75-11N	060-24W
73-59N	066-08W
72-39N	071-03W
71-13N	075-15W
69-42N	078-52W
66-07N	082-00W
66-29N	084-43W
64-49N	087-06W
63-07N	089-12W
61-23N	091-04W
59-37N	092-44W
57-51N	094-14W
56-04N	095-35W
54-15N	096-50W
52-26N	097-58W
50-37N	099-00W
48-47N	099-58W
46-57N	100-52W
45-05N	101-42W
43-14N	102-30W
41-22N	103-14W
39-30N	103-56W
37-38N	104-35W
35-46N	105-13W
33-58N	105-49W
32-01N	106-24W
30-08N	106-57W
28-15N	107-28W
27-00N	107-49W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 7. HEN HOUSE, Olenegorsk. Geographic Coordinates
Along [] Azimuth.*

Latitude ° ' "	Longitude ° ' "
66-29N	036-38E
64-49N	039-00E
63-06N	041-06E
61-23N	042-58E
59-37N	044-58E
57-51N	046-08E
56-03N	047-50E
54-15N	048-44E
52-26N	049-32E
50-36N	050-55E
48-46N	051-53E
46-56N	052-46E
45-05N	053-37E
43-13N	054-24E
41-22N	055-08E
39-30N	055-50E
37-38N	056-30E
35-46N	057-07E
33-53N	057-43E
32-00N	058-18E
30-08N	058-51E
28-15N	059-23E
26-22N	059-53E
24-29N	060-23E
22-35N	060-52E
20-42N	061-20E
18-49N	061-47E
16-55N	062-14E
15-01N	062-40E
13-08N	063-06E
11-14N	063-31E
09-21N	063-56E
07-27N	064-21E
05-33N	064-46E
03-39N	065-10E
01-46N	065-35E
00-08S	065-59E
02-02S	066-23E
03-55S	066-47E
05-49S	067-12E
07-43S	067-36E
08-58S	067-53E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 8. HEN HOUSE, Olenegorsk. Geographic Coordinates
Along [] Azimuth.*

Latitude ° ' "	Longitude ° ' "
67-12N	038-25E
66-10N	042-34E
65-03N	046-22E
63-49N	049-52E
62-31N	053-03E
61-09N	055-58E
59-44N	058-38E
58-16N	061-05E
56-45N	063-21E
55-12N	065-25E
53-37N	067-20E
52-00N	069-07E
50-22N	070-46E
48-42N	072-19E
47-01N	073-45E
45-19N	075-06E
43-37N	076-23E
41-53N	077-35E
40-09N	078-44E
38-24N	079-49E
36-39N	080-51E
34-53N	081-50E
33-07N	082-47E
31-20N	083-41E
29-33N	084-33E
27-45N	085-24E
25-57N	086-13E
24-09N	087-00E
22-21N	087-47E
20-32N	088-32E
18-44N	089-15E
16-55N	089-58E
15-06N	090-41E
13-17N	091-22E
11-28N	092-03E
09-38N	092-43E
07-49N	093-23E
05-59N	094-03E
04-10N	094-42E
02-20N	095-21E
00-31N	096-00E
00-42S	096-26E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

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25X1

25X1D

Table 9. HEN HOUSE, Angarsk. Geographic Coordinates
Along 80-Degree Azimuth.*

Latitude o i	Longitude o i
52-53N	103-15E
53-11N	106-32E
53-24N	109-51E
53-31N	113-11E
53-32N	116-32E
53-26N	119-52E
53-18N	123-13E
53-03N	126-31E
52-42N	129-46E
52-16N	132-58E
51-45N	136-06E
51-09N	139-09E
50-28N	142-07E
49-43N	145-00E
48-54N	147-47E
48-01N	150-29E
47-04N	153-05E
46-40N	155-35E
45-01N	158-00E
43-54N	160-20E
42-45N	162-34E
41-33N	164-44E
40-19N	166-49E
39-03N	168-49E
37-45N	170-45E
36-25N	172-37E
35-03N	174-25E
33-39N	176-09E
32-15N	177-51E
30-48N	179-29E
29-21N	178-56W
27-53N	177-24W
26-23N	175-54W
24-53N	174-26W
23-21N	173-00W
21-49N	171-37W
20-16N	170-15W
18-43N	168-55W
17-09N	167-36W
15-34N	166-18W
13-59N	165-02W
11-20N	162-57W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 10. HEN HOUSE, Angarsk. Geographic Coordinates
Along 260-Degree Azimuth.*

Latitude o i	Longitude o i
52-53N	103-15E
54-21N	99-49E
55-26N	96-55E
56-28N	93-51E
57-24N	90-38E
58-15N	87-15E
59-00N	83-42E
59-40N	80-01E
60-13N	76-11E
60-39N	72-15E
60-58N	68-13E
61-10N	64-07E
61-14N	59-59E
61-10N	55-51E
60-59N	51-45E
60-41N	47-42E
60-15N	43-45E
59-43N	39-55E
59-04N	36-13E
58-19N	32-40E
57-28N	29-16E
56-32N	26-02E
55-32N	22-57E
54-27N	20-02E
53-17N	17-17E
52-05N	14-40E
50-49N	12-11E
49-39N	09-51E
48-08N	07-38E
46-43N	05-32E
45-17N	03-33E
43-46N	01-39E
42-18N	00-09W
40-46N	01-52W
38-49N	03-54W
37-38N	05-04W
36-02N	06-34W
34-25N	08-01W
32-47N	09-24W
31-08N	10-44W
29-28N	12-01W
26-57N	13-53W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 11. HEN HOUSE, Angarsk. Geographic Coordinates
Along 260-Degree Azimuth.*

Latitude o i	Longitude o i
52-53N	103-15E
52-26N	99-31E
51-56N	96-29E
51-22N	93-17E
50-43N	90-17E
50-00N	87-29E
49-12N	84-33E
48-21N	81-49E
47-25N	79-11E
46-26N	76-38E
45-24N	74-11E
44-19N	71-50E
43-11N	69-33E
42-00N	67-29E
40-47N	65-15E
39-31N	63-13E
38-14N	61-16E
36-55N	59-32E
35-33N	57-33E
34-11N	55-47E
32-46N	54-05E
31-21N	52-25E
29-54N	50-49E
28-26N	49-16E
26-57N	47-45E
25-26N	46-16E
23-56N	44-50E
22-24N	43-25E
20-51N	42-03E
19-18N	40-42E
17-44N	39-22E
16-10N	38-04E
14-35N	36-48E
13-00N	35-32E
11-24N	34-17E
09-48N	33-03E
08-12N	31-50E
06-26N	30-38E
04-59N	29-25E
03-22N	28-14E
01-45N	27-02E
00-40S	25-15E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

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Table 12. HEN HOUSE, Angarsk. Geographic Coordinates
Along Azimuth.*

Latitude o i	Longitude o i
52-53N	103-15E
51-39N	105-49E
50-29N	108-15E
49-02N	110-33E
47-40N	112-43E
46-15N	114-47E
44-48N	116-44E
43-18N	118-36E
41-48N	120-23E
40-16N	122-06E
38-41N	123-41E
37-06N	125-14E
35-30N	126-43E
33-53N	128-08E
32-14N	129-30E
30-35N	130-50E
28-55N	132-06E
27-14N	133-21E
25-33N	134-33E
23-51N	135-43E
22-08N	136-51E
20-25N	137-57E
18-42N	139-03E
16-58N	140-06E
15-13N	141-09E
13-29N	142-11E
11-44N	143-12E
09-59N	144-12E
08-14N	145-11E
06-28N	146-10E
04-43N	147-08E
02-57N	148-06E
01-12N	149-04E
00-34S	150-02E
02-20S	151-00E
04-05S	151-58E
05-51S	152-57E
07-36S	153-55E
09-21S	154-54E
11-06S	155-54E
12-51S	156-55E
14-36S	157-56E
15-46S	158-37E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 13. Sary-Shagan ATC Radar Site 1. Geographic
Coordinates Along Azimuth.*

Latitude o i	Longitude o i
45-59N	73-39E
46-39N	70-14E
47-07N	67-24E
47-31N	64-31E
47-51N	61-36E
48-06N	58-39E
48-16N	55-40E
48-21N	52-40E
48-23N	49-40E
48-19N	46-40E
48-11N	43-41E
47-58N	40-43E
47-41N	37-47E
47-19N	34-53E
46-52N	32-01E
46-22N	29-13E
45-46N	26-26E
45-09N	23-46E
44-26N	21-08E
43-41N	18-34E
42-51N	16-04E
41-59N	13-38E
41-04N	11-17E
40-06N	08-59E
39-05N	06-45E
38-01N	04-35E
36-56N	02-28E
35-48N	00-26E
34-38N	01-33W
33-26N	03-29W
32-12N	05-22W
30-57N	07-12W
29-40N	08-59W
28-22N	10-43W
27-03N	12-24W
25-42N	14-04W
24-20N	15-41W
22-57N	17-15W
21-33N	18-48W
20-09N	20-19W
18-43N	21-49W
16-34N	24-01W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 14. DOG HOUSE, Moscow. Geographic Coordinates
Along Azimuth.*

Latitude o i	Longitude o i
55-30N	36-41E
57-08N	34-47E
58-44N	32-43E
60-18N	30-27E
61-49N	27-58E
63-18N	25-13E
64-42N	22-11E
66-03N	18-49E
67-19N	15-05E
68-29N	10-58E
64-33N	06-25E
70-28N	01-25E
71-15N	04-01W
71-51N	09-50W
72-17N	15-60W
72-30N	22-23W
72-31N	28-51W
72-19N	35-14W
71-56N	41-26W
71-21N	47-19W
70-35N	52-48W
69-41N	57-53W
68-39N	62-29W
67-29N	66-40W
66-14N	70-27W
64-54N	73-51W
63-30N	76-56W
62-02N	79-43W
60-31N	82-15W
58-57N	84-33W
57-22N	86-38W
55-44N	88-34W
54-05N	90-20W
52-24N	91-57W
50-42N	93-28W
48-59N	94-52W
47-15N	96-10W
45-30N	97-24W
43-44N	98-33W
41-58N	99-38W
40-11N	100-39W
38-23N	101-38W
37-12N	102-15W

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

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Table 15. DOG HOUSE, Moscow. Geographic Coordinates Along Azimuth.*

Latitude °	Longitude °
55-30N	36-41E
53-50N	38-26E
52-09N	40-02E
50-27N	41-32E
48-44N	42-55E
46-60N	44-13E
45-15N	45-29E
43-29N	46-34E
41-42N	47-39E
39-55N	48-40E
38-08N	49-38E
36-20N	50-33E
34-32N	51-26E
32-43N	52-16E
31-49N	52-41E
29-60N	53-28E
28-10N	54-14E
26-20N	54-56E
24-31N	55-41E
22-40N	56-23E
20-50N	57-03E
18-60N	57-43E
17-09N	58-22E
15-19N	58-59E
13-28N	59-37E
11-37N	60-13E
09-46N	60-50E
07-55N	61-25E
06-04N	62-01E
04-13N	62-36E
02-22N	63-11E
00-30N	63-46E
01-21S	64-21E
03-12S	64-56E
05-03S	65-32E
06-54S	66-07E
08-45S	66-43E
10-36S	67-19E
12-27S	67-55E
14-18S	68-32E
16-08S	69-09E
17-59S	69-46E
20-08S	70-33E

*Coordinates at regular intervals from site to a distance of approximately 5,000 nm.

Table 16. Computer-determined Azimuths and Distances Between Possibly Related Points

From	To	Distance nm (±10)	Azimuth
52-53N 103-15E (Angarsk)	46-35N 074-31E (SSATC Site 13)	1,171	
46-35N 074-31E (SSATC Site 13)	52-53N 103-15E (Angarsk)	1,171	
46-35N 074-31E (SSATC Site 13)	45-55N 063-20E (Tyuratam)	467	
45-55N 063-20E (Tyuratam)	46-35N 074-31E (SSATC Site 13)	467	
68-06N 033-55E (Olenegorsk)	46-35N 074-31E (SSATC Site 13)	1,787	
46-35N 074-31E (SSATC Site 13)	68-06N 033-55E (Olenegorsk)	1,787	
52-53N 103-15E (Angarsk)	68-06N 033-54E (Olenegorsk)	2,107	
68-06N 033-54E (Olenegorsk)	52-53N 103-15E (Angarsk)	2,107	
68-06N 033-54E (Olenegorsk)	55-29N 036-41E (Moscow DOG HOUSE)	763	
55-29N 036-41E (Moscow DOG HOUSE)	68-06N 033-54E (Olenegorsk)	763	
55-29N 036-41E (Moscow DOG HOUSE)	42-50N 045-15E (Intersection "X") (*)	829	
42-50N 045-15E (Intersection "X") (*)	55-29N 036-41E (Moscow DOG HOUSE)	829	
42-50N 045-15E (Intersection "X") (*)	46-35N 074-31E (SSATC Site 13)	1,264	
46-35N 074-31E (SSATC Site 13)	42-50N 045-15E (Intersection "X") (*)	1,264	

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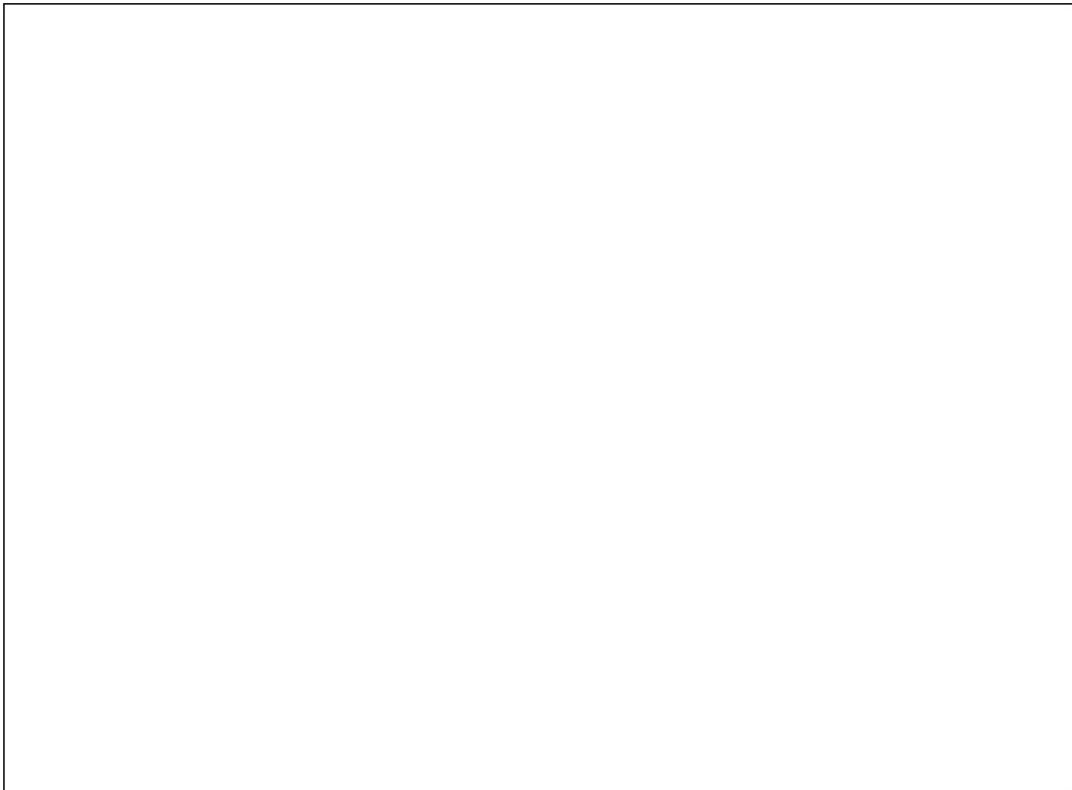
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PHOTOGRAPHY



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MAPS OR CHARTS

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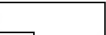
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REQUIREMENTS

CIA. C-RR4-81,377

CIA. C-SI4-81,881

CIA. C-SI4-81,900

CIA. C-DI4-81,873

PROJECT

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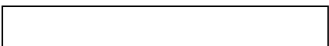
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